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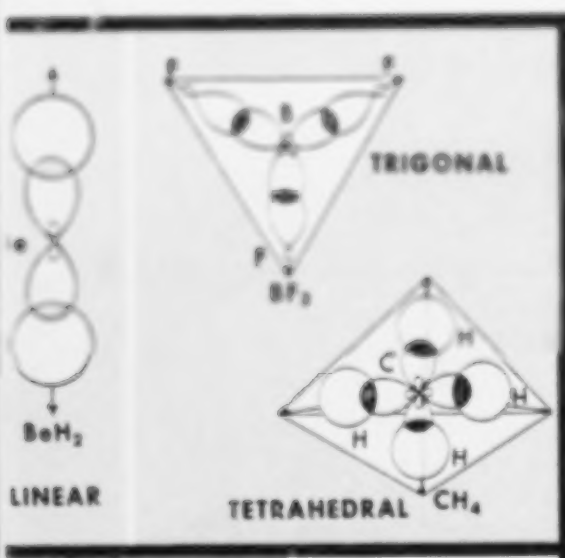
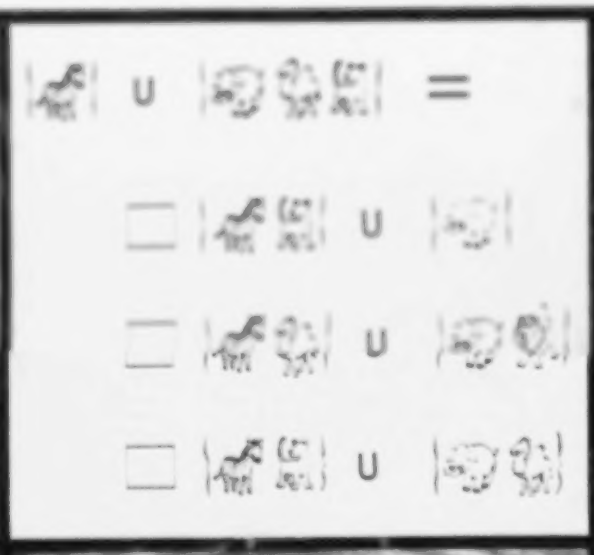
# SCIENCE COURSE IMPROVEMENT PROJECTS

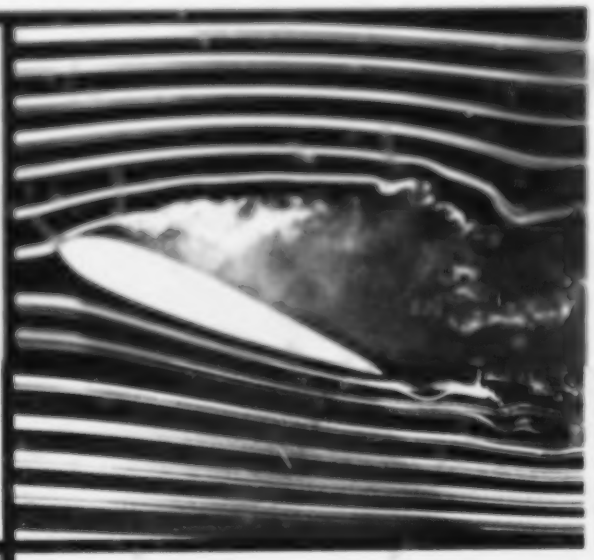
1 *Courses, Written Materials, Films, Studies*

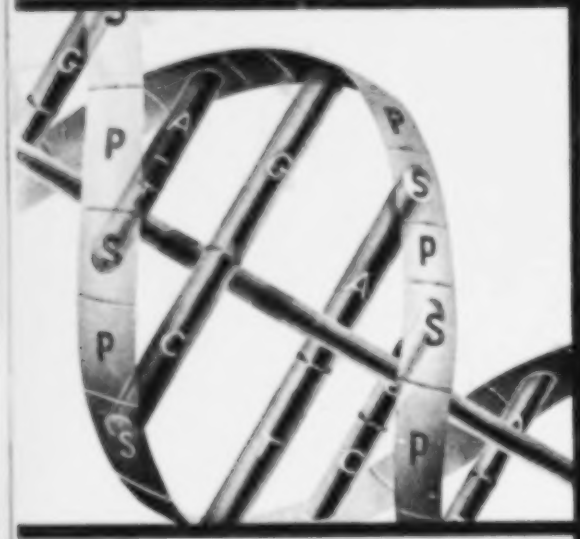
October, 1962
NSF 62-38

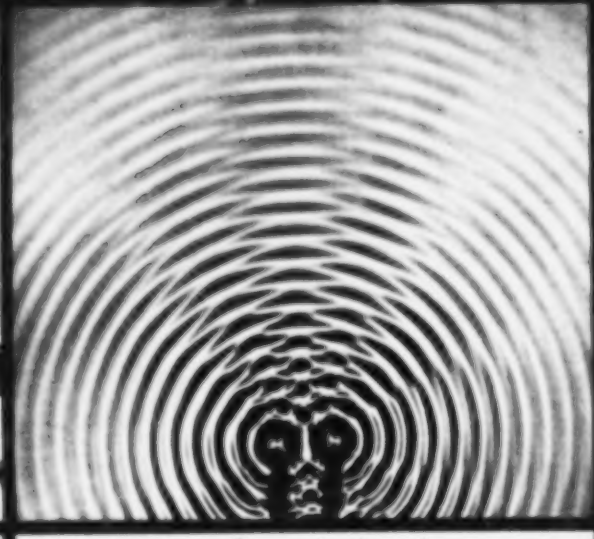
SUPPORTED BY THE NATIONAL SCIENCE FOUNDATION

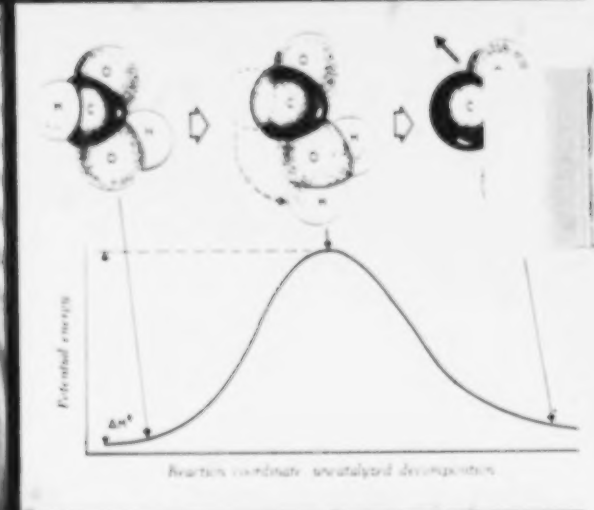


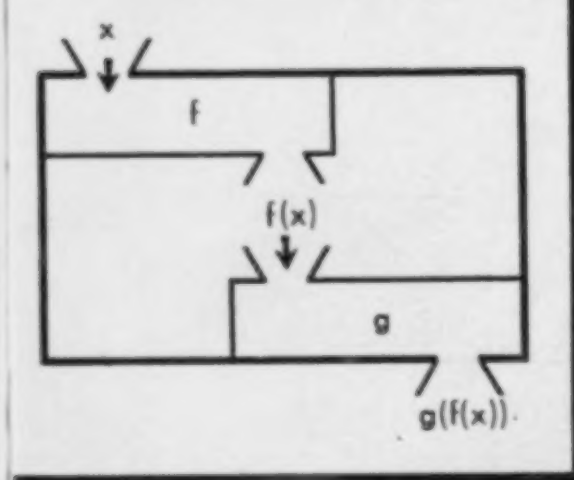



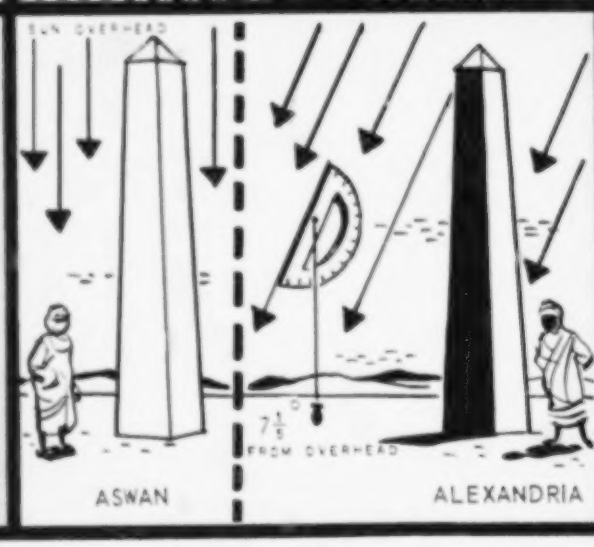


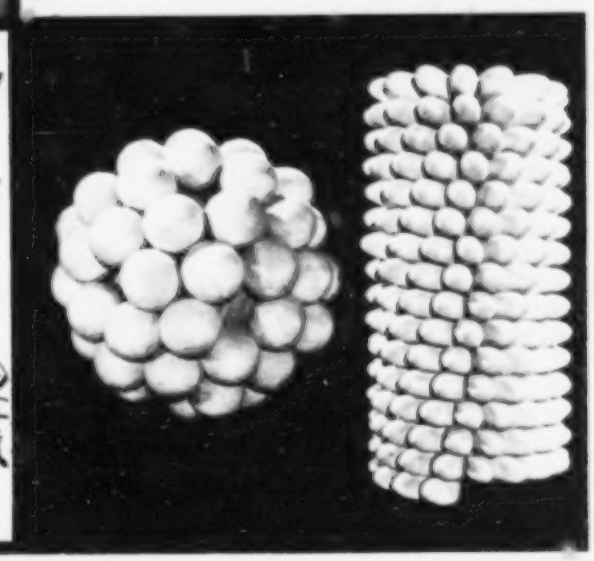






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## FOREWORD

Science and the applications of science are rapidly changing the conditions of life on this planet. Today, for the first time in history, there is no need for anyone to go hungry. Progress in understanding living things promises greater and greater success in overcoming disease. Increasingly, also, man is freeing himself from drudgery while multiplying the variety of things it is possible for him to do. In very many ways the plans and expectations of Americans, and indeed of people everywhere, depend upon a strong and growing science and technology.

The increasing importance of science to our Nation and the world creates pressing educational demands. Literacy in science is becoming essential for all citizens who wish to comprehend the world they live and work in and to participate in the increasing number of local and national decisions, some of gravest import, that require an understanding of science. Further, more and more students must be attracted to scientific and technical pursuits, and these students must be prepared to work with increasingly sophisticated ideas and techniques.

Very practical considerations compel us to give attention to the strengthening of science education. But there is another aspect of the matter, namely, the principle held by those taking part in the reform of science education that more emphasis should be *given to disciplined,* creative, intellectual activity as a noble enterprise and to intellectual achievement as a worthy end in itself. There is a desire to allow each student to experience some of the excitement, beauty, and intellectual satisfaction that scientific pursuits afford. Similar movements also aimed at giving the student experiences and points of view heretofore largely limited to professionals in a field are beginning to go forward in the humanities and the arts. These experiences, it is hoped, will lead many to enter scholarly professions themselves and others to adopt some of the scholarly and artistic modes of thought in their work and their avocations.

Good teachers and good schools have always worked individually to give students the best educational fare they could. Nowadays, however, the task of bringing the best that has been thought to all students—in ways appropriate to their varied interests, abilities, and future lives—requires new strategy and tactics. We live in an age of explosive growth of knowledge. More scientific and technological discoveries have been made in the past fifteen years than in all previous recorded time. Powerful new insights are being gained into the fundamental structure of major areas of inquiry. Moreover, traditional assumptions about what students at given levels of development can learn are increasingly found to be misleading in many ways. Finally, society can no longer afford to wait a generation or more for new knowledge to make its way gradually into school and college programs.

In the last few years, mathematicians, scientists, engineers, and educators have taken up these new educational challenges with great vigor. Working together, and aided by increasing public and private support for educational research and development, they have undertaken a number of fresh approaches to the improvement of school instruction in mathematics and science. In colleges and universities, research scientists have been taking an increasing interest in undergraduate instruction. The aim has been to see that instruction presents contemporary knowledge as well as contemporary viewpoints on knowledge established earlier. In many cases it has seemed best to start anew rather than merely to patch up older courses. A distinctive feature of many projects is the effort made to go beyond the presentation of what is known and to provide students with experience in the processes by which new facts, principles, and techniques are developed.

The purpose of this booklet is to help make information widely available on course improvement projects supported by the National Science Foundation. Decisions on what to teach remain, in the healthy American tradition, the exclusive responsibility of individual schools and teachers. The National Science Foundation *does not* recommend the adoption of any specific book, film, piece of apparatus, course or curriculum. It is hoped, however, that the products of these projects will prove to merit serious consideration by every school and college.

BOWEN C. DEES, *Assistant Director for Scientific Personnel and Education*

# INTRODUCTION

The National Science Foundation's Course Content Improvement Program is designed to help bring scholarship of the highest order to the development of courses and instructional materials that reflect contemporary scientific knowledge and points of view. The program is concerned with the substance of courses in science and mathematics in elementary and secondary schools and in mathematics, science, and engineering in colleges and universities. It thus complements the wide variety of educational programs of the National Science Foundation designed to assist students to pursue scientific studies and to enable scientists and science teachers to keep pace with the progress of research.

Course content improvement projects enable scholars who are masters of their fields to focus their knowledge and imagination on the creation of new courses and materials. Their work involves the cooperation of highly competent teachers and educators, as well as technical assistance of various sorts. Support is limited to design and development of courses and materials. Preliminary versions may be tested in selected schools, but the final products are expected to make their way on their own merits. Full information about these projects is made readily available to the scientific and educational communities, but grant funds may not be used to promote the acceptance of any particular course or materials.

This publication includes reports from all course content improvement projects supported up to October 1, 1962, with the exception of projects under the Science Teaching Equipment Development Program (formerly New Laboratory Equipment Program) which will be described in a companion publication scheduled for release soon after the present publication. A few related projects supported under other Foundation programs are included. Each description is taken from information supplied by the project director and represents the director's view of the project. The project director's name, department and institution are given following the title (more than one name is given when there are co-directors or for other reasons made clear in the listing). Unless otherwise noted, the grant supporting the project was made to the director's institution or organization. Dates in parentheses refer to the period of support by the National Science Foundation; an open termination date indicates that the project intends to seek support for continuation of the work beyond the period of the most recent grant.

Projects are classified by educational level—elementary school, secondary school, technical institute, college and university—and within each level by discipline, as shown in the Table of Contents. The sequence within a discipline is generally chronological according to starting date but in some cases related projects have been grouped together without regard to chronology. Descriptions of projects involving more than one level or discipline are put in what seems to be the most appropriate place, with cross references under other appropriate categories. Multiple levels are also given in parentheses following the title.

Many persons concerned with education in the sciences will find it useful, it is hoped, to look through the entire book, in addition to giving more careful scrutiny to projects at the various levels in their own fields of interest. In almost all cases, a source of further information is given. *Inquiries concerning individual projects should be sent to the project director or other source cited and* **not** *to the National Science Foundation.*

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# SCIENCE COURSE IMPROVEMENT PROJECTS

## I. ELEMENTARY SCHOOL PROJECTS

### A. Mathematics

**1. EXPERIMENTAL TEACHING OF MATHEMATICS IN THE ELEMENTARY SCHOOL.** PATRICK SUPPES, Institute for Mathematical Studies, Stanford University, Stanford, California. (1959– )

This project aims at modernization and improvement of the mathematics curriculum in grades 1 through 6 to provide a stronger content from additional branches of mathematics as early as the primary grades. The approach to number and arithmetical operations is through the concept of set and operations on sets. This content from set theory is considered to be logically prior to arithmetical content and, being more concrete, to be more readily comprehended by the beginning student. Through this foundation and the introduction of explicit notation, the aim is to emphasize precision and accuracy in the presentation of mathematical ideas. A series of workbooks, *Sets and Numbers*, has been developed for grades 1 and 2. The books include work on set, number, set relations, number relations, standard applications of arithmetic, and considerable work with variables and elementary geometrical constructions. In 1961–62 these materials were tested in 122 classes (grades 1 and 2) in 32 schools. In 1960–61, 25 first grade classes tested the first level books. The books were then revised on the basis of both teacher suggestions and testing.

A closely related project on the teaching of mathematical logic to talented fifth graders is also under way. An experimental textbook entitled *Mathematical Logic for the Schools* has been written for this project.

**Sources of Further Information:**

Patrick Suppes and Blair McKnight, "Sets and Numbers in Grade One, 1959-1960," *The Arithmetic Teacher* 8, 287 (1961).

Patrick Suppes and Rose Ginsberg, "Application of a Stimulus Sampling Model to Children's Concept Formation with or without an Overt Correction Response", *Journal of Experimental Psychology* 63, 330 (1962).

Patrick Suppes and Rose Ginsberg, "A Fundamental Property of All-or-None Models, Binomial Distribution of Responses Prior to Conditioning, with Application to Concept Formation in Children," *Psychological Review* (in press).

Patrick Suppes and Rose Ginsberg, "Experimental Studies of Mathematical Concept Formation in Young Children", *Science Education* 46, 230 (1962).

Experimental editions of workbooks for grades 1 and 2 as well as kindergarten will be available from Blaisdell Publishing Company, 22 East 51st Street, New York 22, New York, in September 1962. The preliminary edition of the third grade *Sets and Numbers* text will be available in September 1962 at cost from the project director, as well as the revised text, *Mathematical Logic for the Schools*, used with fifth and sixth graders. Further details on the two projects are available on request from the project director.

**2. GEOMETRY PROJECT.** NEWTON S. HAWLEY, Department of Mathematics, Stanford University, Stanford, California. (1959– )

The Geometry Project is a large-scale experiment in the teaching of geometry in elementary schools. More than 5,000 students have participated in this program. The current text *Geometry —A Workbook for Reading and Construction* by Newton S. Hawley, went into use beginning in September 1961. The geometry material is designed for use by *all* students rather than for use by only the so-called "gifted" child. Further, the material is designed so that the regular classroom teacher does the instructing—there is no need for consultants or supervisors from outside the school. (Classes have been taught successfully by teachers who have never before studied geometry.) It should be emphasized that *Geometry* is *not* intended to replace arithmetic. The techniques learned in arithmetic are essential in themselves. The geometry program relies strongly on the text matter which the student himself reads. This material is thus part of the reading program and also serves as an introduction to the reading, with comprehension, of technical matter of significant content. The time required for the course is 15 or 20 minutes a day.

**Sources of Further Information:**

A brief report with information about this project will be sent upon request to Dr. Hawley.

**3. PATTERNS IN ARITHMETIC.** HENRY VAN ENGEN, Departments of Education and Mathematics, Uni-

versity of Wisconsin, Madison 6, Wisconsin. (1961– )

This is a television course taught in Racine, Milwaukee, Madison, and suburban communities in Wisconsin to test the idea of teaching arithmetic to teachers and pupils simultaneously. The lessons cover the standard arithmetic program from a modern point of view. Lessons in geometry and number theory are offered as enrichment work for the better pupils. Approximately 70 television lessons are being developed for each grade level. The lessons are 15 minutes in length and offered twice a week. In this time all of the essential theory can be covered. Suggestions for teachers and exercise sheets for pupils accompany the television program. The exercises are sufficient in length and quantity to serve as the basic program for the entire year. Accompanying the series for pupils is a series of ten half-hour telecasts entitled *Orientation Programs for the Teacher*. These programs are spaced so as to occur about every three weeks. They give an over-all view of the material to be covered in the next three weeks and mathematical content of the program for the pupils.

**Sources of Further Information:**

Kinescopes are available for use by other educational television stations together with workbooks for the pupils and suggestions for the teachers. Inquiries concerning these materials should be sent to Professor Henry Van Engen, Patterns in Arithmetic Project, 325 North Murray Street, Madison, Wisconsin.

**4. SYRACUSE UNIVERSITY-WEBSTER COLLEGE MADISON PROJECT.** *(Elementary, Secondary)* ROBERT B. DAVIS, Department of Mathematics, Syracuse University, Syracuse 10, New York. (Grantee: Webster College, Webster Groves 19, Missouri.) (1961– )

This project conducts extensive experimentation with children as a result of which it prepares and distributes materials related to a program of algebra, geometry, arithmetic, and mathematical physics intended as a supplement to, rather than a replacement for, a standard arithmetic program. Materials available at present are suitable for all children in grades 3-8 but with emphasis on brighter children and on grades 5 and 6; alternatively, the materials are suitable for slower children in grades 8, 9, and 10. Materials include: (1) a "student discussion guide" (which constitutes the basic "text") and accompanying teacher's manual soon to be published by Addison-Wesley Publishing Company, Inc., Reading, Massachusetts; (2) tape recordings and films of actual classroom lessons intended for teacher training, PTA meetings, etc. (available through the project director at Webster College); (3) a film series, entitled, *The Ability of Children*, intended to demonstrate that young children have a far greater capacity for creative mathematical work than is usually recognized; (4) various new materials on vector and matrix algebra, digital computers, similar triangles, centimeter blocks, etc., intended for children who have completed the study of the basic text. Materials for younger children are in preparation. The project also engages in various teacher training activities and cooperates in a new program at Webster College for the education of elementary school mathematics specialists. Project materials are, in general, more demanding of time, effort, and devotion from teachers who wish to use them than is ordinarily the case; it is hoped that the results with children repay the greater effort required from the teacher.

**Sources of Further Information:**

Up-to-date lists of available materials can be obtained by writing to the project director at Webster College.

*See also:*

29. SURVEY OF RECENT EAST EUROPEAN LITERATURE IN SCHOOL AND COLLEGE MATHEMATICS
30. SCHOOL MATHEMATICS STUDY GROUP (SMSG)
32. UNIVERSITY OF ILLINOIS COMMITTEE ON SCHOOL MATHEMATICS (UICSM)
97. ACTIVITIES OF THREE FILM COMMITTEES, II
102. EXPERIMENTAL MOTION PICTURES FOR ELEMENTARY SCHOOL MATHEMATICS
103. FILMS FOR MATHEMATICS TEACHERS
104. COMMITTEE ON THE UNDERGRADUATE PROGRAM IN MATHEMATICS (CUPM)
108. MATHEMATICS COURSES FOR PROSPECTIVE ELEMENTARY SCHOOL TEACHERS
111. MATHEMATICS COURSE FOR PROSPECTIVE ELEMENTARY SCHOOL TEACHERS
112. FILMS IN MATHEMATICS FOR ELEMENTARY SCHOOL TEACHERS
115. COURSE IN MATHEMATICS FOR PROSPECTIVE JUNIOR HIGH SCHOOL TEACHERS

# B. Mathematics and Science

**5. COORDINATED SCIENCE AND MATHEMATICS CURRICULUM FOR GRADES K-9.** PAUL C. ROSENBLOOM, Minnesota School Mathematics Center, University of Minnesota, Minneapolis 14, Minnesota. (1961- )

The purpose of this project is to produce science and mathematics materials for children and for preservice education of teachers. Mathematics materials for K-3 have been produced and are being tried in 47 classes this year. The first goal in the mathematics is to teach children how to work with graph paper so that they will have a geometrical model of the real number system. This will enable them to learn arithmetic, algebra, and geometry simultaneously. Outlines for the science will be drawn up this year, and writing teams will begin work June 1963. There will be emphasis on classification, measurement, prediction, and observation. An aim is that the science and mathematics curricula be sound in their own right but that all possible connections be exploited. The program will be sequential, each later unit being based on previous work. Next year about 20 to 25 experimental centers will be established at colleges around the country. For several years the materials will be used only under supervision of a cooperating college.

**Sources of Further Information:**

A sketch of the program appeared in: P. C. Rosenbloom, "A Leap Ahead in School Mathematics", *Science and Mathematics: Countdown for Elementary Schools*, p. 24. Frontiers of Science Foundation of Oklahoma, Inc., College of Education, University of Oklahoma, Norman, Oklahoma (1960). Further information may be obtained from the project director.

# C. Science

**6. EXPLORATORY CONFERENCE ON SCIENCE IN THE ELEMENTARY SCHOOL.** GLENN O. BLOUGH, Department of Education, University of Maryland, College Park, Maryland. (Grantee: National Science Teachers Association, 1201 16th St., N. W., Washington 6, D. C.) (1958)

This project consisted of a work conference with representative science teachers, science supervisors, school principals and administrators, and scientists. The main purposes of the conference were: (1) to develop recommendations and actions for extending and strengthening programs of science in elementary schools, and (2) to prepare for publication a report to be of use to those responsible for planning and supervising elementary school science programs. The five major problems discussed were: (1) What are the characteristics of a good elementary school science program? (2) By what process may a school system improve its elementary school science curriculum and teaching? (3) What are the most helpful experiences in science for in-service elementary teachers? (4) What pre-service experiences characterize good programs for elementary teachers? and (5) How do we determine what equipment, books, and other educational materials are essential to good science instruction?

**Sources of Further Information:**

The published report of the conference, *It's Time for Better Elementary School Science*, was widely distributed to those responsible for curriculum development in science and is available for $1.00 from the National Science Teachers Association.

**7. "TIME FOR SCIENCE" ENRICHMENT SERIES FOR TELEVISION.** MRS. EDMUND D. CAMPBELL, The Greater Washington Educational Television Association, Inc., Raleigh Hotel, 12th and Pennsylvania Avenue, N.W., Washington 5, D. C. (1959)

The science enrichment series was developed to give further illustration or demonstration of scientific principles and projects which were included in the *Time for Science* television lessons presented twice each week over WTTG, a commercial station. They were received by approximately 40,000 fifth and sixth grade pupils in fourteen school systems in the Washington Metropolitan area. Through the grant, a color kinescope was made for each of the 23 programs. These 16-mm films are being made available for rental to schools, colleges, and scientific societies. Each half-hour film features a working scientist who presents process and product or natural phenom-

en... The series presents scientific laboratories and agencies in operation, photographs, carefully constructed demonstrations, and settings appropriate to the mood and manner of development. Attention is given to the motivation of young students toward careers in science through a better understanding of scientific methods and procedures as well as the phenomena of the natural world.

**Sources of Further Information:**

Information on rentals may be obtained from The Greater Washington Educational Television Association, Inc.

**8. SCIENCE CURRICULUM IMPROVEMENT STUDY.** ROBERT KARPLUS, Department of Physics, University of California, Berkeley 4, California. (Address 1962–63: Department of Physics, University of Maryland, College Park, Maryland.) (1959– )

The Study is exploring a concept of science education based on communicating scientific literacy. The large scale organization of the curriculum (sometimes called "scope and sequence") is to be determined by the structure of science, by the increasing maturity of the pupils, and by the pupils' preconceptions. Single lessons or groups of lessons are designed to lead students to discover the significance of certain scientific concepts. These lessons include individual pupil manipulation and experimentation, group activities, and class-wide demonstrations and discussion.

At present, experimentation is in progress to find how the learning experience should be planned so that a secure connection is achieved between the pupils' preconceptions or common-sense attitudes and the concepts that embody the modern scientific point of view. Some of the latter that are being considered are the concept of interaction between objects as the cause for the phenomena that occur, the concept of physical system (including living organisms), the concept of relativity of position and motion, the concept of equilibrium, the concept of energy, the concept of force, the concept of entropy, and the concept of organic evolution.

In addition to the instructional program, the Study has considered the significance of the teacher's attitude during the science class. It is important that the scientific concepts not be introduced in an authoritarian fashion. Instead, they should serve as a useful tool with which the pupils can achieve a better understanding or explanation of some phenomena they have observed. The curriculum maker and teacher have a special obligation if such instruction is to succeed. They have to furnish evidence that will be truly convincing and acceptable to the pupil.

Preliminary results during the past year have been encouraging. Some effective teaching procedures have been developed, but limitations of the pupils' ability to deal with abstractions have also been encountered.

**Sources of Further Information:**

Robert Karplus, "Beginning a Study in Elementary School Science," *American Journal of Physics* 30, 1 (1962).

Robert Karplus, "The Science Curriculum—One Approach," *The Elementary School Journal* 62, 243 (1962).

J. Myron Atkin and Robert Karplus, "Discovery or Invention?" *The Science Teacher* 29, 45 (1962).

John Cunningham and Robert Karplus, "The Free Fall Demonstration Experiment," *American Journal of Physics* 30, 656 (1962).

Information about subsequent reports may be obtained from the director. No tested teaching materials for direct classroom use are available at present.

**9. ELEMENTARY SCHOOL SCIENCE PROJECT.** ROBERT C. STEBBINS *(Chairman)*, Department of Zoology, and STEPHEN P. DILIBERTO *(Director)*, Department of Mathematics, University of California, Berkeley 4, California. (1959– )

The project was formed to make it possible for scientists at the University of California to contribute to improvement of the elementary-school science curriculum. Since its beginning in 1959, the project has been largely devoted to experimentation with units developed under the direction of the various scientists of the project. The experimentation is largely carried on in normal public school classes in cooperation with regular teachers. Units that have reached the experimental stage treat topics in applied mathematics, mechanics, human physiology, natural selection, and physical chemistry. Other units under development treat wave motion, ecology, and plant science. Material developed by the project is not made generally available during experimental stages. After sufficient experiment and

revision, however, units will be issued in a form that permits wide distribution.

**Sources of Further Information:**

Additional information about the project may be found in a publication of the National Science Teachers Association, the *Elementary School Science Bulletin*, Issue No. 66 (1961).

Requests for information or material should be addressed to the Elementary School Science Project, 2232 Piedmont Avenue, Berkeley 4, California.

**10. ELEMENTARY-SCHOOL SCIENCE PROJECT.** J. MYRON ATKIN, Department of Education, and STANLEY P. WYATT, JR., Department of Astronomy, *University of Illinois, Urbana, Illinois. (1960– )*

Project activity has centered on astronomy. The guiding principles of the staff are two: (1) whatever science is taught to children should be sound and correct; (2) what is taught should reflect the essential structure of the subject. By structure is meant the relatively few but powerful concepts and principles that hold the subject together and that help the student make an entity of his own of what otherwise is solely a collection of disparate facts.

A basic task in the project has been the attempt to identify major themes of astronomy. Among these themes, as the directors see them, are the measurement of length and distance, the construction of conceptual models that account for astronomical observations, the physical force of gravitation, the nature of a star, the life story of stars, the structure of our galaxy and the universe of galaxies, and cosmology.

During the summer of 1961, a staff consisting of three professional astronomers, two professional educators, and three assistant astronomers completed the first two of a series of books for children, with accompanying teacher's guides. (1) *Charting the Universe* covers such topics as measurement, distances in the solar system and beyond, the size and shape of the earth, and the inverse square law as a tool for finding very great distances. (2) *Gravitation* deals first with such concepts as velocity, acceleration, mass, and force. Then follows the story of the 2000-year development of the theory of planetary motions, culminating with Newton and gravitation. Examples are drawn from apple, moon, and a variety of celestial objects from earth satellites to galaxies. The trial editions were studied by about 7500 children in 250 classrooms throughout the country during 1961–62, with a concentration of classes in grades five and six. Classes ranged from bright to below average. Extensive feedback procedures were established for purposes of evaluation.

During the summer of 1962, a slightly larger group of astronomers and teachers revised the books on the basis of the year's trial. Content in Book 2 was expanded and allocated to two books. The new Book 2, *The Universe in Motion*, outlines conceptual models to account for observed motion. The student is introduced to geocentric and heliocentric perspectives. The new Book 3, *Gravitation*, draws heavily on the original second book.

Future books to be prepared include *Atoms and Starlight*, which asks how the astronomer knows what a star is. Included will be some rudiments of the kinetic theory of gases, atomic structure, and radiation theory. The fifth book will deal with stellar evolution; the sixth one will introduce the student to our galaxy, other galaxies, and cosmology.

Astronomy is a prime example of an interdisciplinary field in the physical sciences, and project books rely heavily on content from mathematics, physics, and chemistry.

**Sources of Further Information:**

J. Myron Atkin, "Teaching Concepts of Modern Astronomy to Elementary-School Children," *Science Education* 45, 54 (1961).

J. Myron Atkin, "The University of Illinois Elementary-School Science Project," *Elementary School Science Bulletin*, Issue No. 66 (1961).

Project books developed to date are available in limited quantity at cost. Requests for further information should be addressed to Elementary-School Science Project, 805 West Pennsylvania Avenue, Urbana, Illinois.

**11. FEASIBILITY STUDY ON MAJOR EFFORTS TO IMPROVE SCIENCE COURSES IN ELEMENTARY AND JUNIOR HIGH SCHOOLS.** *(Elementary, Junior High)* DAEL WOLFLE and JOHN R. MAYOR, American Association for the Advancement of Science, 1515 Massachusetts Avenue, N. W., Washington 5, D. C. (1960-1961)

The purpose of the feasibility study was to bring together in regional conferences scientists and leaders in education, including teachers in the elementary and junior high schools, to con-

sider the present status of science education at this level, what improvements are needed, and how these improvements might be brought about. Three regional conferences of about fifty persons each were held during 1961 in St. Louis, Missouri; Berkeley, California; and Washington, D. C. As a part of the work of the project, working papers were prepared for the conferences and later printed in *School Science and Mathematics* in April and May 1961. A final summary report of the recommendations of the conferences was published in the June 23, 1961, issue of *Science* under the title, "Science Teaching in the Elementary and Junior High Schools." A fourth conference, including representatives from science and education, was held in September 1961 for discussion of possible further action.

The conferees agreed that there was an urgent need for improved programs in science for elementary and junior high schools, that there should be no single national curriculum but several different programs developed by working teams of scientists and teachers; and that there should be an over-all advisory group to bring about some coordination of the several efforts in elementary and junior high school science course content improvement.

**Sources of Further Information:**

While the feasibility study has been terminated, a limited number of reprints of the working papers and of the final report are still available. There is no plan to print additional copies when the present supply is exhausted. Inquiries should be addressed to Dr. Mayor.

**12. ELEMENTARY SCHOOL SCIENCE AND CURRICULUM STUDY PROJECT.** PHILIP MORRISON, Department of Physics, Cornell University, Ithaca, New York. (Grantee: Educational Services Incorporated, 164 Main Street, Watertown 72, Massachusetts.) (1962- )

During the summer of 1962 a large and varied group was brought together for an intensive study of how best to introduce the concepts and the spirit of science into elementary classrooms. The group consisted of some 25 research scientists in many fields and an equal number of experienced elementary school teachers and supervisors. A few people who have carried on research on the learning process were included, and the whole group had ample support from artists, photographers, and laboratory and shop technicians of many kinds. A few school classes were operated concurrently for try-out and observation.

The plan is to work out principles for the curriculum more or less as a whole and then to construct trial sample portions of it to serve as a pilot for subsequent filling in. These samples will include text, graphic material, apparatus and materials, teachers' aids, and the remaining "full kit" of instructional needs. The work began late in June 1962. Topics and levels chosen for the pilot work will be reported later. Materials will also be available at a later date.

**Sources of Further Information:**

Further information is available from Educational Services Incorporated.

**13. SCIENCE TEACHING MATERIALS FOR ELEMENTARY AND JUNIOR HIGH SCHOOLS.** JOHN R. MAYOR, American Association for the Advancement of Science, 1515 Massachusetts Avenue, N. W., Washington 5, D. C. (1962- )

A Commission on Science Instruction will be responsible for planning, staffing, and managing the activities of this project. Commission membership includes scientists recognized for their achievement in scientific research, school administrators, science education specialists, and teachers in the schools. Among the responsibilities that may be assumed by the Commission are: (1) to maintain a continuous review of work on improvement in science instruction, grades K-9, which is being done under its own and other auspices, and of the kinds of additional work that would most effectively supplement what has already been started; (2) to develop interest within the scientific community and recruit scientists to work on the development of elementary and junior high school science materials; (3) to arrange conferences, communication, and exchange of materials among various groups working in this area as needed; (4) to assist with evaluation of materials prepared; (5) to serve as an advisory board to persons interested in the establishment of new programs or centers for the development of science materials, and to agencies that might be interested in providing financial support for such activities; and, (6) to provide interpretation and help in the selection and use of any new science materials.

Two eight-day conferences were sponsored by the Commission during the summer of 1962, one in July at Cornell University and the other in

August at the University of Wisconsin. The conferences considered, among other topics pertinent to the development of materials in science and education: (1) implications of the new secondary school courses in science and the new secondary and elementary school programs in mathematics for work which might be done at the elementary and junior high school levels in science, (2) research in science education, (3) research in learning. The conferences prepared first drafts of statements of the purposes and objectives of elementary science, possible sequences in science for grades K through 9, sample laboratory experiences in science, and outlines of a few units which might be developed at an early date. Recommendations were made on work which might be undertaken during the next calendar year with Commission sponsorship.

**Sources of Further Information:**

It is not expected that recommendations or sample materials for tryout will be ready for distribution before the fall of 1963. Further information will be available from the project director.

See also:
10. "LIVING BIOLOGY" FILM SERIES
22. VISUAL AIDS FOR TEACHING CHEMISTRY
33. TEACHING RESOURCES DEVELOPMENT PROGRAM IN THE GEOLOGICAL SCIENCES (GULF/IN CONFERENCE)
37. STUDY ON FUNDAMENTAL PROCESSES IN EDUCATION
38. REGIONAL CONFERENCES OF SCHOOL ADMINISTRATORS ON NEW SCIENCE CURRICULA
47. ACTIVITIES OF THREE FILM COMMITTEES, III
73. TELEVISION COURSE ON SCIENCE FOR ELEMENTARY SCHOOL TEACHERS

# II. SECONDARY SCHOOL PROJECTS

## A. Anthropology

**14. FILM SERIES: "SCIENCE UNDER PRESSURE: ARCHEOLOGICAL SALVAGE IN THE UNITED STATES."** *(Secondary, College)* E. Mott Davis, Department of Anthropology, The University of Texas, Austin 12, Texas. (1961-1963)

This project is directed toward the production of six half-hour sound-color films on the subject of archeological research in the United States. The basic purpose of the series is to present one type of scientific activity as it actually takes place —as scholarship, as practical engineering and management in field and laboratory, and in general as one of the many human activities that are integral parts of modern civilization. The aim is to challenge the student who might undertake scientific work—the kind who is both practical-minded and intellectually oriented. The focus of the series is on reservoir salvage archeology, which provides a forceful example of the close interrelationship between non-scientific matters and scientific research.

The first film will be introductory in nature, discussing United States archeology as a whole and the crisis that exists today because of the destruction of archeological sites by construction work—reservoirs, highways, urban expansion, and the like. Each of the other films takes one area of the United States as an example. Within an area, the story of prehistoric man is first reviewed; a field excavation in progress is then visited, with the archeologist in charge outlining the problems he faces in carrying on a good research job—problems of scholarship and cultural history, of techniques and equipment, of finances, of organization, and so on. Students will be given a brief review of the pre-history of the United States, a summary of archeological techniques in field and laboratory, a look at the personal side of the archeologist's work, and an appreciation of the fact that science not only affects the rest of life but is in turn affected by it.

The films are 16-mm color-sound motion pictures, each one lasting 29½ minutes. Each film can be viewed independently of the others, but they are designed to be most effective when viewed in sequence as a series. Film subjects are as follows: (1) *Salvaging American Prehistory;* (2) *Forest and Prairie: Archeology in the Eastern United States;* (3) *The Great Plains;* (4) *The Southwest and Great Basin;* (5) *The Northwest and Pacific Coast;* (6) *The Coordinated Archeological Salvage Effort in Texas, and Summarizing Remarks.*

**Sources of Further Information:**

Beginning in 1963, copies of the films will be

available for rental by schools and colleges from the Film Booking Office of the Visual Instruction Bureau, Division of Extension, The University of Texas, Austin 12, Texas, and for purchase from Radio Television, The University of Texas. Free prints will be made available for telecasts on educational television or commercial television stations by The University of Texas and through the facilities of the National Educational Television and Radio Center, 10 Columbus Circle, New York 19, New York.

**13. ANTHROPOLOGY CURRICULUM STUDY PROJECT.** MALCOLM COLLIER, Anthropology Curriculum Study Project, 5632 Kimbark Avenue, Chicago 37, Illinois. (Grantee: American Anthropological Association, 1530 P Street, N. W., Washington 5, D.C.) (1962- )

A re-evaluation of social studies as taught in secondary schools is now under way as part of a general effort to improve high school curricula. Anthropology, as such, is not part of the traditional school program, but the subject matter of anthropology and the concepts developed by anthropologists from this subject matter have great potential usefulness for helping students comprehend the complexities of the world they study in social studies programs. This educational potential will be explored by evaluating existing uses of anthropological material in school programs and in teacher education, and by pooling the experience and knowledge of teachers, anthropologists, and curriculum specialists to determine the curriculum needs to which anthropology can contribute both substantive data and a conceptual framework. Materials are being developed for specific and general courses. These include: annotated bibliographies of printed materials, tapes, films, museum facilities, and other resources; booklets covering the time periods, people and places which are the special concern of anthropologists, presented so that teachers and students see this material in the framework of anthropological concepts; and selected readings.

**Sources of Further Information:**

A report of the project and a bibliography of articles on anthropology and education, including some on specific anthropology courses in high schools, are available from the project director.

See also:
43. AMERICAN INDIAN FILMS

## B. Biology

**14. BIOLOGICAL SCIENCES CURRICULUM STUDY (BSCS).** BENTLEY GLASS *(Chairman)*, Department of Biology, The Johns Hopkins University, Baltimore 18, Maryland; ARNOLD B. GROBMAN *(Director)*, Biological Sciences Curriculum Study, University of Colorado, Boulder, Colorado. (Grantee: American Institute of Biological Sciences, 2000 P Street, N. W., Washington 6, D. C.) (1959- )

Three modern high school biology courses, prepared respectively from a molecular and evolutionary, a general and cellular, and an ecological and evolutionary approach, each with text, laboratory manual, and teacher's guide, are being designed. In addition, laboratory blocks, planned to present six weeks of concentrated investigation by regular classes on specific biological areas of investigation, have been prepared as follows: *Animal Growth and Development; Plant Growth and Development; Interdependence of Structure and Function; Microbial Growth and Nutrition; Plant Hormones; Animal Behavior; Ecology of Land Plants and Animals;* etc. Two volumes containing a total of 151 selected scientific investigations suitable for especially gifted students have been prepared, and a bulletin by Paul DeH. Hurd entitled *Secondary School Biology in the United States: 1890-1960* has been published. Several short movie films illustrating biological techniques are available for the assistance of the teacher. A volume, *Equipment and Techniques for the Biology Teaching Laboratory*, describes many devices for homemade and inexpensive equipment and simplified techniques. A *Teacher's Handbook* discusses the aims, philosophy, and methods of the BSCS and also contains "Invitations to Enquiry," which are prepared discussions on selected biological subjects that simultaneously bring out aspects of scientific method and philosophy, such as interpretation of data, formulation of hypotheses, nature of "causes," teleology, etc. Committees are working actively also on problems of teacher preparation, foreign utilization of BSCS materials, other types of publications, learning aids, and tests and evaluation.

**Sources of Further Information:**

Preliminary versions of the materials were prepared in 1960 and 1961 and tested in schools in 1960-61 and 1961-62. Further revision and trial will be carried out during 1962-63. Definitive editions of the materials will be published commercially in time for use by all interested schools in the fall of 1963.

Bentley Glass, "Perspectives: A New High School Biology Program," *American Scientist* 49, 524 (1961).

*BSCS Newsletter*, Numbers 1-13, obtainable from the Biological Sciences Curriculum Study, University of Colorado, Boulder, Colorado.

Bentley Glass, "Renascent Biology: A Report on the AIBS Biological Sciences Curriculum Study," *The School Review* 70, 16 (Spring 1962).

**17. FILMS ON THE NATURE OF VIRUSES.** *(Secondary, College)* WENDELL M. STANLEY, Virus Laboratory, University of California, Berkeley 4, California. (1959-1960)

The general objective of this project is to help acquaint high school and college students and teachers and the general public with recent accomplishments of research in virology and its implications for understanding certain fundamental problems in biology, and to broaden general appreciation of the role of research in basic science. The series consists of eight 16-mm black-and-white sound films, each thirty minutes in length. The films were prepared by the project director and six senior staff members of the Laboratory, aided by E. G. Valens, Jr., and in cooperation with educational television station KQED-TV, San Francisco, W. A. Palmer Films, Inc., and the University's Department of Visual Communications. The films have been shown on educational television stations throughout the country beginning November 27, 1960. Titles of the films are:

1. *Between the Living and the Non-living*
2. *Giant Molecules*
3. *The Stuff of Life*
4. *Viral Genes*
5. *How Viruses Kill*
6. *Threads of Life*
7. *Killers and Carcinogens*
8. *Cancer*

**Sources of Further Information:**

Wendell M. Stanley and Evans G. Valens, Jr., *Viruses and the Nature of Life*, based on the television series, E. P. Dutton and Company, New York (1961).

Information on rental and purchase of the films can be obtained from the National Educational Television and Radio Center, 10 Columbus Circle, New York 19, New York.

**18. THREE EDUCATIONAL FILMS ON MYXOMYCETES.** *(Secondary, College, Graduate School)* T. R. PORTER, College of Education, State University of Iowa, Iowa City, Iowa. (1960-1961)

Films are as follows:

*Slime Molds I: Life Cycle*, U-5518, 30 minutes, sound-color or black-and-white. The fascinating and complex life cycle of one myxomycete is revealed in detail by a combination of high and low magnification, phase contrast, dark field, bright field, normal speed, and time-lapse cinephotomicrography. Form is related to function. Unsolved problems are pointed out. The uniqueness of myxomycetes is stressed. Animation is used to point out details, such as mitosis. Similarities and differences in the life cycle of different species are indicated.

*Slime Molds II: Collection, Cultivation and Use*, U-5519, 19 minutes, sound-color. The techniques involved in collection, cultivation, and use of the myxomycetes are presented by taking the viewer into the field and laboratory. A few selected studies on slime molds are reviewed through animation. Some projects are suggested. Several classroom demonstrations are shown.

*Slime Molds III: Identification*, U-5520, 24 minutes, sound-color. The use of a key is illustrated by comparing a modified portion of Professor G. W. Martin's key to a road map. Each road is followed until the main families of myxomycetes are identified. Representative genera and species are shown through a variety of photographic techniques. The reasons for identification, keys, terminology, and scientific names are given. Animation is used to show the parts of fruiting bodies used in identification of the slime molds.

**Sources of Further Information:**

The films are available from the Audio-Visual Center, State University of Iowa, Iowa City, Iowa, for rental or sale. Requests for films should be sent to the Audio-Visual Center. Requests for further information should be sent to the project director.

**19. "LIVING BIOLOGY" FILM SERIES.** *(Elementary, Secondary, College)* ROMAN VISHNIAC, Yeshiva

University, 110 West 57th Street, New York 19, New York. (1960- )

The project is using a new approach to improvement of biology teaching in secondary schools, colleges and universities. A series of 16-mm sound-color films is being produced during observations and study of the behavior of animals and the life of plants in their natural habitats. The camera becomes, in effect, a part of the biosphere. Students see the events happening in native environments as if they were the original investigators; they see the dynamic living processes upon which current interpretation and theory are based.

The *Living Biology* films are designed to show the actual life and functions of organisms—their processes, behavior, structure, and physiology. The present objective is to produce a series of approximately 75 films of various lengths for secondary schools and colleges. Films for elementary schools may also be proposed. Tentative titles of some of the films are: *The Living Tide; The Life of the Pond; Protozoa; Microscopic Plants-Protophyta; From Sponges to Mollusca; Arthropoda through Vertebrata; Physiology of Life; Life of the Sea Floor; Plankton of the Sea; Biology of the Bee; Growth and Development; Microbiology.* Distribution of films will begin during 1963.

**Sources of Further Information:**

Inquiries concerning the films should be addressed to the project director.

See also:
45. COMMITTEE ON EDUCATIONAL POLICIES IN BIOLOGY
48. SHORT FILMS IN MICROBIOLOGY
53. FILM SERIES: "THE PROMISE OF THE LIFE SCIENCES"
56. CINEPHOTOGRAPHIC TECHNIQUES IN MORPHOLOGY
57. DEVELOPMENTAL ANATOMY FILMS
58. PLANT SCIENCE FILMS
132. FILM SERIES ON SCIENTIFIC DEVELOPMENTS IN PSYCHOLOGY

## C. Chemistry

**20. CHEMICAL BOND APPROACH PROJECT (CBAP).** LAURENCE E. STRONG, Department of Chemistry, Earlham College, Richmond, Indiana. (1958- )

The Chemical Bond Approach (CBA) course in chemistry is based on the premise that the first chemistry course can be taught more effectively if the course is based on a central theme smaller than all of chemistry. In developing the CBA course, ideas are used to provide organization for the experimental observations of chemistry. Central to these ideas is an understanding of the electrical nature of matter and a description of chemical bonds in terms of the limiting prototypes referred to as ionic, covalent, and metallic bonds. Much attention is given to structure, both through bond types and through electrostatic forces. Throughout the course theories are used with frequent reference to "mental models." In addition to structural models, models for kinetic theory and energy are treated extensively.

In the laboratory program the student not only collects various data but also applies ideas to these data. The laboratory experiments are presented as problems and, insofar as possible, the student is encouraged to decide what information is necessary to solve the problem. Ideally, information from both the laboratory and the literature is fitted into a logical scheme based on a set of assumptions and often a mental model. In most cases, the solution to the problem suggests other paths to follow, and the student is encouraged to follow up such "extensions." In the laboratory there is reduced emphasis on the determination of a numerical result alone, and increased emphasis on the development of a reasoned conclusion. The importance of quantitative and reproducible work, or the learning of manipulations, is not minimized but it is not made a goal in itself.

A series of achievement tests is being revised with the assistance of Educational Testing Service, and the tests are distributed and administered by this organization. With these tests as a major criterion, data have been collected on student achievement in relation to independent measures of aptitude. Correlation of achievement and aptitude suggests that the course pattern makes a significant contribution to student development. At present, a controlled study is under way to compare student achievement in CBA with students in more conventional courses.

The materials produced for use in the high schools to date include a second revised edition of the two-volume text and *Student Laboratory Guide*, a collection of supplementary readings for CBA from the *Journal of Chemical Education* and another collection from *Scientific American*, a teacher's guide to accompany the laboratory experiments, and a chart of atomic and ionic radii.

**Sources of Further Information:**

Laurence E. Strong and M. Kent Wilson, "Chemical Bonds: A Central Theme for High

School Chemistry," *Journal of Chemical Education* 35, 56 (1958).

Laurence E. Strong, "Facts, Students, Ideas," *Ibid.* 39, 126 (1962); "The CBAC Chemistry Course," *Chemistry* 33, 1 (1960).

"A CBAC Progress Report," *Ibid.* 34, 1 (1960).

"The CBAC Laboratory Program," *Ibid.* 34, 1 (1961).

"CBAC Evaluation, 1960-1961," *Ibid.* 35, 18 (1961).

Laurence E. Strong, "Chemistry as a Science in the High School," *The School Review* 70, 44 (Spring 1962).

The third revised edition of the CBA program together with a teacher's guide will be published by the McGraw-Hill Publishing Company, New York, in time for use in the school year 1963-64.

Newsletters, a complete price list of all current publications, and other information concerning the project can be obtained by writing to the project director. In particular, single sets of the text and student's laboratory guide are available postpaid for $4.50. (Please make checks payable to Earlham College, CBA.)

**21. CHEMICAL EDUCATION MATERIAL STUDY (CHEM Study).** GLENN T. SEABORG *(Chairman)*, Atomic Energy Commission, Washington 25, D. C.; J. A. CAMPBELL *(Director)*, Department of Chemistry, Harvey Mudd College, Claremont, California. (Grantee: University of California, Berkeley 4, California) (1959- )

CHEM Study is experimenting with means for making a first chemistry course as profitable as possible for all students who wish to take such a course. The text, laboratory manual, teacher's guide, and motion pictures emphasize heavily the experimental approach to chemistry and the importance of laboratory work. This experimental emphasis has been used to develop the major concepts, such as dynamic equilibrium, rates and mechanisms of reactions, chemical bonding, structural ideas, and the systematics of chemistry in terms of the periodic table. The course tries to present chemistry from the point of view of a person intimately involved in the profession of chemistry, but in terms both interesting to and comprehensible by typical beginning students. A series of tests produced and distributed in cooperation with Educational Testing Service indicates that the general goal of the Study has been achieved with the 15,000 students throughout the nati who have so far taken the course.

**Sources of Further Information:**

Glenn T. Seaborg, "New Currents in Chemical Education," *Chemical and Engineering News* 38, 97 (1960).

J. A. Campbell, "The Chemical Education Materials Study," *Journal of Chemical Education* 38, 2 (1961).

Lawrence D. Lynch, "Report on CHEM Study Program," *Science World* 10, No. 2, 3-T (1961).

J. A. Campbell, "Chemistry—An Experimental Science," *The School Riview* 70, 51 (Spring 1962).

*CHEM Study Newsletter*, obtainable from Chemical Education Material Study, Harvey Mudd College, Claremont, California.

Examination copies of the text, laboratory manual, and teacher's guide are available from CHEM Study, Claremont, California, at a cost of $5 per set.

Motion pictures (16 mm, sound-color, running between 15 and 22 minutes) are now available, or in production, covering the areas of kinetics of reactions, catalysis, equilibrium, ionization energy, vibration of molecules, molecular spectroscopy, synthesis of an organic compound, mechanism of an organic reaction, gases and how they combine, and chemical families. Some fifteen other pictures are currently in the planning stage. Films may be purchased from CHEM Study at $130 a print or at $100 a print in sets of five or more.

The Study has also produced some wall charts and special pieces of equipment which will be available through various suppliers. Inquiries concerning the charts should currently be sent to the Welch Scientific Company, 1515 Sedgwick Street, Chicago 10, Illinois or to Central Scientific Company, 1700 Irving Park Road, Chicago 13, Illinois.

The commercially published version of the text and laboratory manual will be available in August of 1963. It will be published in cooperation with the W. H. Freeman Company of San Francisco, California.

Inquiries concerning the course should be addressed to CHEM Study, Claremont, California.

**22. VISUAL AIDS FOR TEACHING CHEMISTRY.** *(Elementary, Secondary, College)* R. T. SANDERSON, Department of Chemistry, State University of Iowa, Iowa City, Iowa. (1959-1964)

Three 45-minute sound-color filmed lecture demonstrations have been produced on the construction and use of new chemistry teaching aids

developed previously: (1) *Atomic Models, Valence, and the Periodic Table;* (2) *New Models of Molecules, Ions, and Crystals: Their Construction and General Use in Teaching Chemistry;* and (3) *A Special Set of Models for Introducing Chemistry.* Other work includes (1) further development of the atomic and molecular models described in the films, (2) development of a laboratory exercise on valence and a lecture aid for teaching atomic structure, (3) development of a device to demonstrate Boyle's law and a machine to simulate the kinetic-molecular nature of gases (from which it is hoped a short film may be made), (4) development of a portable 3-dimensional periodic table.

**Sources of Further Information:**

R. T. Sanderson: *Chemical Periodicity,* Reinhold Publishing Corporation, New York (1960).

"Principles of Chemical Bonding," *Journal of Chemical Education* 38, 382 (1961).

"Models for Demonstrating Electronegativity and Partial Charge," *ibid.* 36, 507 (1959).

"Atomic Models in Teaching Chemistry," *ibid.* 37, 307 (1960).

"Valence: A Laboratory Exercise for General Chemistry," *ibid.* 37, 261 (1960).

"An Aid to Teaching Electronic Configurations of Atoms," *ibid.* 37, 262 (1960).

Films are available for rental or purchase from the Extension Division, University of Iowa. A supplementary booklet, *Principles and Construction of New Chemistry Teaching Aids,* is supplied free with each film rental and can be purchased separately at cost.

The most complete information concerning the construction and teaching applications of atomic and molecular models will become available soon in a new book, *Three-Dimensional Teaching of Chemistry,* to be published by D. Van Nostrand Company, Inc., Princeton, New Jersey. The models may soon become available through a national distributor. Similar models are available from Marco Models, P.O. Box 287, South San Francisco, California.

**See also:**
64. FILMS FOR GENERAL COLLEGE CHEMISTRY

## D. Earth Sciences

**23. TEACHING RESOURCES DEVELOPMENT PROGRAM IN THE GEOLOGICAL SCIENCES (DULUTH CONFERENCE).** *(Elementary, Secondary)* ROBERT L. HELLER, Department of Geology, University of Minnesota, Duluth 12, Minnesota. (Grantees: National Academy of Sciences-National Research Council, 2101 Constitution Avenue, N. W., Washington 25, D. C.; University of Minnesota.) (1959-1962)

The Duluth Conference held in the summer of 1959 was the first specific project undertaken by the American Geological Institute in its Teaching Resources Development Program in the Geological Sciences. At this conference, a group of 35 elementary and secondary school science teachers, geologists, and scientists from fields related to geology worked as a writing team to prepare a sourcebook for science teachers. Materials prepared by the writing group were reviewed and tested by teachers and scientists and subsequently revised prior to publication. The revised version of the sourcebook resulting from the Duluth Conference has been published by Holt, Rinehart & Winston, Inc., under the title, *The Geology and Earth Sciences Sourcebook for Elementary and Secondary Schools.* It contains 18 chapters dealing with the scientific phenomena of the lithosphere and hydrosphere, and one each on atmospheric science and astronomy. The last three chapters of the *Sourcebook* contain geological information designed to supplement high school biology, chemistry, and physics curriculum materials.

Recognizing the rapidly developing trend to introduce earth science courses in schools across the country, the American Geological Institute plans to continue its program to develop such additional teaching resource materials as text and laboratory materials, teaching films, and other teaching aids for use in both elementary and secondary schools. The Institute is also concerned with improving teacher preparation for earth science teaching.

**Sources of Further Information:**

Information on the Duluth Conference is reported in articles appearing in *GeoTimes,* a professional news magazine published by the American Geological Institute, Vol. 3, No. 6, 14; Vol. 3, No. 8, 20; Vol. 4, No. 3, 20.

Information about the *Sourcebook,* other teaching resource materials, and career guidance literature is available from the American Geological Institute, 2101 Constitution Avenue, N.W., Washington 25, D. C.

**24. OCEANOGRAPHY—EIGHT NARRATED FILMSTRIPS.** RICHARD C. VETTER, Committee on Oceanography, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, N. W., Washington 25, D. C. (1962-1963)

A series of eight narrated filmstrips on oceanography is being produced including a 15-minute general introduction to oceanography and seven 10-minute strips on physical, meteorological, geological, chemical, and biological oceanography, oceanographic resources, and engineering oceanography. A booklet accompanying each set will contain eight articles written by leading marine scientists in each field, a study guide for teachers, an extensive bibliography, and other reference material of value to students and teachers. Each strip is designed to be used either as part of the complete series for general science courses, or independently in classes in biology, physics, chemistry, etc.

**Sources of Further Information:**

Further information about this project may be obtained from the project director.

*See also:*
97. ACTIVITIES OF THREE FILM COMMITTEES, I

## E. General

**25. "HORIZONS OF SCIENCE"—SERIES OF TEN SCIENCE FILMS.** *(Secondary, College)* JOHN S. HOLLISTER, Educational Testing Service, Princeton, New Jersey. (1959-1960)

The *Horizons of Science* film program consists of ten 20-minute, 16-mm, sound-color films, designed to communicate the excitement of science and an understanding of the significance of a number of current scientific projects. The films allow the audience to take, in effect, actual field trips with prominent scientists and hear them explain in their own words their work and its importance.

Titles of films are as follows:

1. *Visual Perception.* An examination of the way we "see" the world around us, with psychologist Hadley Cantril.
2. *The Worlds of Dr. Vishniac.* Microscopic photography of living creatures and insights into the complexities of evolving life, with microbiologist Roman Vishniac.
3. *Exploring the Edge of Space.* Development and use of plastic balloon systems, with Otto C. Winzen, aeronautical engineer-designer.
4. *"Thinking" Machines.* Approaches and experiments in machine intelligence, with Claude Shannon of the Massachusetts Institute of Technology; Alex Bernstein of International Business Machines; and Leon Harmon of Bell Laboratories.
5. *The Mathematician and the River.* The relationship between the "abstract" world of mathematics and the "real" world of nature, with Eugene Isaacson of New York University's Institute of Mathematical Sciences.
6. *New Lives for Old.* A case history in cultural anthropology among the Manus of the Admiralty Island, with Margaret Mead of the American Museum of Natural History.
7. *Project "Mohole".* Report on a major scientific project to drill a hole to the interior of the earth; films of the U. S. oceanographic expedition surveying possible sites.
8. *The Realm of the Galaxies.* An inquiry into the farthest reaches of the universe, with Allan R. Sandage of Mt. Wilson and Palomar Observatories.
9. *The Flow of Life.* An examination of basic research in biochemistry and physiology centered on the microcirculation of blood and the capillary bed, with Benjamin Zweifach of New York Medical Center and others.
10. *Neutrons and the Heart of Matter.* Research in atomic and nuclear physics at Brookhaven National Laboratory, with Donald J. Hughes.

**Sources of Further Information:**

"New Science Films", *The Science Teacher* 27, 23 (1960).

Films, with study guides for each, general descriptive brochure, and progress reports are available from Horizons of Science, Educational Testing Service.

**26. CONFERENCE AND REPORT ON SCIENCE IN SECONDARY SCHOOLS, GRADES 7-12.** ROBERT STOLLBERG, Division of Science, Mathematics, and Engineering, San Francisco State College, San Francisco, California. (Grantee: National Science Teachers Association, 1201 16th Street, N. W., Washington 6, D. C.) (1959-1960)

This project consisted of a work conference with representative participants from science teachers, science supervisors, school principals and administrators, and scientists. The conference dealt primarily with problems of course content, curriculum offerings and sequence, guidance

of students into proper courses, and facilities for the support of instruction. Specific purposes included: (1) defining and stating the most pressing problems confronting secondary school science programs; (2) developing suggested criteria and procedures for solving some of the problems identified, with consideration of existing and potential plans and programs; (3) formulating a statement of recommended policies which should govern the evaluation and revision of course content and sequence for secondary school science; and (4) publishing and distributing the findings of the conference group.

**Sources of Further Information:**

The published report of the conference, *Planning for Excellence in High School Science*, is available for $1.00 from the National Science Teachers Association.

**27. STUDY ON FUNDAMENTAL PROCESSES IN EDUCATION.** R. M. WHALEY, Advisory Board on Education, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, N. W., Washington 25, D. C. (Present address: Wayne State University, Detroit 2, Michigan.) (1959)

One result of contemporary work on the improvement of school and college instructional programs in various disciplines has been sharply increased awareness of the great need for substantial augmentation of penetrating research on the processes of learning and teaching, and for better communication among scholars concerned with content and psychologists concerned with processes. Recognizing the problem, the National Academy of Sciences-National Research Council convened two conferences during 1958 to explore the need for better research in education and mechanisms for meeting these needs. These meetings led to the organization of the so-called Woods Hole Conference held in the summer of 1959.

The purpose of the Woods Hole meeting was to focus the attention of scholars in specific disciplines and behavioral scientists on means for improving instruction in competently defined subject matter through wise and effective use of current psychological and technological developments. Financial support for the conference was provided by the U. S. Office of Education and the National Science Foundation. With Dr. Jerome S. Bruner of Harvard University as chairman, the conference involved approximately 60 leaders in physics, mathematics, biology, history, psychology, and education. Their deliberations clearly underscored promising directions for expansion of basic research on educational processes in intimate cooperation with studies on the development of improved courses, curricula, and instructional materials.

**Sources of Further Information:**

Jerome S. Bruner, *The Processes of Education*, Harvard University Press, Cambridge 38, Massachusetts (1960).

Further information can be obtained from Dr. Whaley or Mr. Robert E. Green, Advisory Board on Education, National Academy of Sciences-National Research Council.

**28. REGIONAL CONFERENCES OF SCHOOL ADMINISTRATORS ON NEW SCIENCE CURRICULA.** *(Elementary, Secondary)* WILLIAM P. VIALL, American Association for the Advancement of Science, 1515 Massachusetts Avenue, N. W., Washington 5, D. C. (1962-1963)

The purpose of these conferences is to present to a selected group of school administrators information relating to new curriculum developments in biology, chemistry, physics, and other scientific disciplines, including first-hand reports of experiences of supervisors and teachers with new materials, and suggestions on introducing new programs into schools.

Sites selected for the nine meetings are: Washington, D. C.; Boston, Massachusetts; New York, New York; Chicago, Illinois; Omaha, Nebraska; Portland, Oregon; San Francisco, California; Oklahoma City, Oklahoma; and, Miami Beach, Florida. These sites have been chosen on the basis of regional distribution of school population, as well as accessibility. About 150 school administrators will be invited to each meeting. The first meeting was held in Washington, D. C., April 30-May 1, 1962. This meeting served as a prototype for the other eight regional conferences scheduled for the fall.

The conferences include a speech by a well-known scientist, followed by a science educator who has had experience with the new programs; presentations by representatives of scientific societies who have been involved in developing science curricula; a panel of classroom teachers who have used the new curricula; a speech by a school administrator who has been instrumental in bringing the curricula to his school; and, a panel of school administrators whose schools have used

the new curricula. Discussion periods will be interspersed throughout the two days. Provision will also be made for exhibition of materials so far developed by the various studies.

**Sources of Further Information:**

Publication of a report for wide distribution is planned when the conference series is completed.

See also:
3. COORDINATED SCIENCE AND MATHEMATICS CURRICULUM FOR GRADES K-9
98. TELEVISION COURSE ON SCIENCE FOR ELEMENTARY SCHOOL TEACHERS

## F. Mathematics

**29. SURVEY OF RECENT EAST EUROPEAN LITERATURE IN SCHOOL AND COLLEGE MATHEMATICS.** *(Elementary, Secondary, College)* ALFRED L. PUTNAM and IZAAK WIRSZUP, Department of Mathematics, The University of Chicago, Chicago 37, Illinois. (1956- )

The Survey is accumulating a representative library of mathematics textbooks, books, periodicals, pamphlet series, resource materials, syllabi, course programs, etc. A major part of the Survey work is the translation and adaptation of some of the best materials from these East European sources, particularly the Soviet Union. Although the Survey is not directly involved in course content improvement, it is hoped that, as these translations are made available in appropriate published form, educators, mathematics teachers, and students will find them useful both as supplements to the formal curriculum in schools and colleges and in teacher training programs. In conjunction with this selective translation program, there is being processed from the Survey library (one of the largest collections of materials of its kind outside the Library of Congress) a more comprehensive sampling of the mathematical literature in the form of excerpts translated from publications in the various categories represented in the Survey collection. A further aim of the Survey is to study the research and experiments relevant to mathematics education in Communist countries and to report these findings to the American public.

**Sources of Further Information:**

I. *Books and pamphlets*

A. To be published by D. C. Heath and Company, Boston:

1. From the Russian series *Popular Lectures in Mathematics*, to appear as *Topics in Mathematics:*

I. P. Natanson, *Simplest Maxima and Minima Problems*, and G. E. Shilov, *How to Construct Graphs*

I. S. Sominskii, *The Method of Mathematical Induction*

N. N. Vorobyov, *The Fibonacci Numbers*

A. I. Markushevich, *Areas and Logarithms*

Ya. S. Dubnov, *Mistakes in Geometric Proofs*

I. P. Natanson, *Summation of Infinitely Small Quantities*

A. I. Fetisov, *Proof in Geometry*

V. G. Shervatov, *Hyperbolic Functions*

A. M. Lopshits, *Computation of Areas of Oriented Figures*

L. I. Golovina and I. M. Yaglom, *Induction in Geometry*

V. G. Boltyanskii, *Equivalent and Equidecomposable Figures*

B. I. Argunov and L. A. Skornyakov, *Configuration Theorems*

B. A. Trakhtenbrot, *Algorithms and Automatic Computing Machines*

E. S. Venttsel', *An Introduction to the Theory of Games*

A. S. Barsov, *What is Linear Programming?*

2. Other books:

A. Ya. Khinchin, *Eight Lectures on Mathematical Analysis*

L. A. Lyusternik, *Convex Figures and Polyhedra*

A. I. Markushevich, *Infinite Series*

E. B. Dynkin and V. A. Uspenskii, *Mathematical Discussions* (in three volumes)

B. To be published by Holden-Day, Inc., San Francisco: A. M. Yaglom and I. M. Yaglom, *Nonelementary Problems in Elementary Exposition* (in two volumes).

C. Published by the School Mathematics Study Group, as volume IV of its

*Studies in Mathematics*: B. V. Kutuzov, *Geometry* (a text used in the Soviet Pedagogical Institutes).

II. *Papers*

The following papers, derived from Survey materials, were published by the College Mathematics Staff, University of Chicago, in *The Mathematics Teacher* and *The Mathematics Student Journal*:

"A Generalization of the Pythagorean Theorem", *The Mathematics Student Journal* 2, No. 2 (1955).

"Three Algebraic Questions Connected with Pythagoras' Theorem," I. *Ibid.* 2, No. 4 (1955).

"Three Algebraic Questions Connected with Pythagoras' Theorem," II. *Ibid.* 3, No. 2 (1956).

"Three Algebraic Questions Connected with Pythagoras' Theorem," *The Mathematics Teacher* 49, 250 (1956).

"A Problem on the Cutting of Squares," *Ibid.* 49, 332 (1956).

"A Problem on the Cutting of Squares," *The Mathematics Student Journal* 3, No. 2 (1956).

"More on the Cutting of Squares," *The Mathematics Teacher* 49, 442 (1956).

"More on the Cutting of Squares," *The Mathematics Student Journal* 3, No. 3 (1956).

"Still More on the Cutting of Squares," *The Mathematics Teacher* 49, 585 (1956).

"On Transforming Rectangles into Squares," *The Mathematics Student Journal* 3, No. 4 (1956).

"New Exercises in Plane Geometry," *The Mathematics Teacher* 50, 125 (1957).

"On the Transformation of Any Rectangle into a Square," *The Mathematics Student Journal* 4, No. 2 (1957).

"More New Exercises in Plane Geometry," *The Mathematics Teacher* 50, 330 (1957).

"On Transforming a Hexagon into a Square," *The Mathematics Student Journal* 4, No. 2 (1957).

"Four More Exercises in Cutting Figures," *The Mathematics Teacher* 51, 96 (1958).

"Coloring Maps," *Ibid.* 50, 536 (1957).

III. *Studies* by Izaak Wirszup

"Some Remarks on Enrichment", *The Mathematics Teacher* 49, 319 (1956). (The paper is concerned with supplementary literature and extracurricular activities in mathematics in the Soviet Union.)

"The Seventh Mathematical Olympiad for Secondary School Students in Poland," *Ibid.* 51, 585 (1958).

"Current School Mathematics Curricula in the Soviet Union and Other Communist Countries," *Ibid.* 52, 554 (1959).

"The Planning and Preparation of a Soviet Mathematics Teacher for Class Work (Calendar Plans and Work Plans)" (mimeographed by the Survey and distributed to interested persons).

"The First Two International Mathematical Olympiads for Students of Communist Countries," *The American Mathematical Monthly* 69, 150 (February 1962).

"The School Mathematics Circle and Olympiads at Moscow State University" (to appear in *The Mathematics Teacher*, 1962).

"The All-Russian Mathematical Olympiads" (to appear, 1962).

**38. SCHOOL MATHEMATICS STUDY GROUP (SMSG).** *(Elementary, Secondary.)* E. G. BEGLE, School of Education, Stanford University, Stanford, California. (Grantees: Yale University and Stanford University.) (1958– )

The principal objectives of the Study Group are the preparation of sample text materials designed to illustrate the kind of curriculum which the members of the group feel is demanded by the increased use of science, technology, and mathematics in our society, and the preparation of materials designed to help teachers prepare themselves to teach such a curriculum.

Sample textbooks for grades 7 through 12 have already been prepared and are available for classroom use pending the preparation of computable materials through the usual commercial channels. The materials for grades 7 and 8 are designed for students of average ability as well as the college capable students, while the materials for grades 9 through 12 are designed only for college capable students (but see below). All SMSG texts are accompanied by teachers' commentaries which provide answers to problems and give some of the mathematical background and the rationale for the manner of presentation of specific topics. These commentaries serve as an integral part of the course in providing in-service aid to teachers.

To provide sample textbooks for students ostensibly less talented mathematically, the SMSG has prepared materials for use in grades 7 through 10. These materials, drawing on the sample texts mentioned above, provide basically the same content with more concrete examples and a somewhat simplified vocabulary. The pace of the series is deliberately slower than that of the earlier texts.

The mathematics curriculum of the elementary school has also received attention. Sample textbooks for grades 4 through 6 have been prepared, and experimental text materials for the earlier grades are in preparation. The elementary school materials are designed for use in self-contained classrooms and, like the junior high school materials, for average students as well as for those of higher ability.

Eight volumes have been designed explicitly for in-service training of teachers. Some of these volumes provide general background information and mathematical substance for teachers at both elementary and secondary school level; others provide specific background requisite to the teaching of particular courses. Evaluation of achievement in SMSG courses was carried out in part by Educational Testing Service and by the Minnesota National Laboratory and is reported in the *SMSG Newsletter No. 10* Currently, a nationwide study is being carried out to investigate aptitudes and attitudes involved in the learning of mathematics. This study will continue over a 5-year period assessing the work in SMSG and other mathematics courses of students now in grades 4, 7, and 10.

Other projects being undertaken by SMSG include:

1. The Monograph Project—preparation of enrichment materials for high school students and teachers. Eight volumes are now available and others are planned.

2. The Translation Project—preparation of SMSG books in Spanish for Puerto Rico and Spanish-speaking classes in the United States. At the moment, grades 7 and 9 are complete; 8 and 10 are in preparation.

3. The Programed Learning Project—preparation of SMSG's *First Course in Algebra* in two programed formats: a constructed response program and a multiple choice program. The preliminary edition of SMSG Programed *First Course in Algebra* will be tested in classrooms during 1962–63 in a variety of experimental situations.

4. The Small Publications Project—preparation of enrichment materials for grades 7 through 12 and also classroom units to introduce some of the newer ideas in classes where full-year course revision is not possible.

5. The Elementary Film Project—preparation of film and text for improving the mathematical background of in-service elementary school teachers.

6. Cooperation with other sciences—some small pamphlets are planned, each dealing with a mathematical topic of importance in science. These pamphlets are designed to bridge the gap between the mathematics as presented in the mathematics classroom and its use in the science classroom. In addition, a combined mathematics-physical science course at about the ninth-grade level is being planned.

**Sources of Further Information:**

A more detailed description of the work of the SMSG can be found in "The Objectives and Activities of the School Mathematics Study Group," by John Wagner in *The Mathematics Teacher* 53, 454 (1960). See also "The School Mathematics Study Group Project on Elementary-School Mathematics," by J. Fred Weaver in *The Arithmetic Teacher* 8, 32 (1960).

The *SMSG Newsletter* is published from time to time announcing new publications and reporting on the activities of the Study Group. Those wishing to be on the mailing list for the *Newsletter* should write to: School Mathematics Study Group, Cedar Hall, Stanford University, Stanford, California.

A publications list indicating price and source, together with order forms, is found in *Newsletter No. 12*.

**31. REGIONAL ORIENTATION CONFERENCES IN MATHEMATICS.** FRANK B. ALLEN, Department of Mathematics, Lyons Township High School and Junior College, La Grange, Illinois. (Grantee: National Council of Teachers of Mathematics, 1201 16th Street, N.W., Washington 6, D.C.) (1960–1963)

During the fall of 1960 the National Council of Teachers of Mathematics conducted eight Regional Orientation Conferences in Mathematics in various parts of the United States. These conferences were held in Philadelphia, Iowa City, Atlanta, Portland, Los Angeles, Topeka, Miami, and Cincinnati. They involved 939 selected school administrators (superintendents and principals),

supervisors, curriculum directors, department chairmen, and teachers. (All fifty states were represented at these conferences.) The purpose of the conferences was to supply the conferees with the information and orientation which would enable them to provide leadership in establishing new and improved mathematics programs in their own local school systems.

Materials distributed included advance copies of the report of the Panel on Teacher Training of the Committee on the Undergraduate Program in Mathematics of the Mathematical Association of America; a statement prepared by the Lyons Township High School mathematics staff, "A Parent Looks at Modern Mathematics"; and basic information about the University of Illinois Committee on School Mathematics, the University of Maryland Mathematics Project, the School Mathematics Study Group, and the Ball State Teachers College Experimental Program.

The program, designed for people who do not have the teacher's knowledge of school mathematics, emphasized the goals common to all the improved programs and gave relatively little attention to the differences among these programs. Comparative analysis was not the business of the Conferences. The purpose was, rather, to arouse enough interest to insure that local studies would be undertaken which could serve as the basis for informed decisions.

The program presented at these conferences was used as the basis for a publication, *The Revolution in School Mathematics*, which was distributed free to all school superintendents, secondary school principals, mathematics supervisors, members of the National Council of Teachers of Mathematics, and participants in the Regional Conferences.

**Sources of Further Information:**

Copies of *The Revolution in School Mathematics* may be obtained by writing to Mr. Myrl E. Ahrendt, Executive Secretary, National Council of Teachers of Mathematics, at the address above.

**32. UNIVERSITY OF ILLINOIS COMMITTEE ON SCHOOL MATHEMATICS (UICSM).** MAX BEBERMAN, University High School, College of Education, University of Illinois, Urbana, Illinois. (1962– )

In December 1951 the Colleges of Education, Engineering, and Liberal Arts and Sciences established the University of Illinois Committee on School Mathematics (UICSM) to investigate problems concerning the content and the teaching of college-preparatory mathematics in grades 9-12. Since that time, its major concern has been with the development of instructional materials and their experimental trial in schools throughout the country. Some new content has been introduced, some of the traditional content has been re-arranged, and many promising pedagogical techniques and approaches have been developed. UICSM is also experimenting in the development of auto-instructional materials. To enable teachers to help in the experimental trials of materials and teaching approaches, the project staff conducts summer training institutes. The UICSM has also produced teacher-training films for such institutes.

The present grant supports a new project for the development of instructional materials in mathematics for grades 7-12. The project staff contemplates experimenting with an integrated and sequential mathematics course which begins with all students in grades 7 and gradually tapers down to students in grade 11 and 12 with "professional" interests in mathematics. By adding new mathematicians to the project staff, it will be possible to experiment with other content areas. For example, experimentation is planned on the use of vectorial methods and on incorporating many applications of mathematics to the natural and social sciences. As in the earlier project, the writers will favor a mode of textbook presentation in which children are encouraged to discover mathematical ideas and principles through exploratory exercises and activities.

A preliminary version of the seventh-grade course will be written in 1962-63 and tried at the University of Illinois laboratory school in 1963-64. A revised version will be tried in selected schools in 1964-65. In addition to classroom trial, the textbook materials will be programmed for auto-instruction. The latter activity, it is found, is extremely useful in providing information for subsequent rewriting of the textbook materials. Text materials for grades 8-12 will be developed and experimented with in a year-by-year fashion. Schools interested in cooperating with UICSM in the experimental trial of new materials are invited to write to the project director.

**Sources of Further Information:**

The basic text materials developed in the *first* project (1951-62) are now obtainable in paper-

back student editions and in bound teacher editions from the University of Illinois Press, Urbana. An information sheet is available from the project director at the following address: UICSM Project, 1208 West Springfield, Urbana, Illinois.

**33. EVALUATION OF SECONDARY-SCHOOL MATHEMATICS CURRICULA.** PAUL C. ROSENBLOOM, Mathematics Section, Minnesota National Laboratory, Minnesota State Department of Education, St. Paul 1, Minnesota. (Grantee: Minnesota Academy of Science.) (1962– )

The evaluation, conducted with 250–300 experimental classes in Minnesota, Wisconsin, Iowa, and the Dakotas, concerns a comparison of the conventional, School Mathematics Study Group, Ball State, Illinois, and Maryland curricula. The evaluation also involves comparison of the effectiveness of teachers before, during, and after experience with new programs; measurement of effectiveness of two-year sequences; effects of experience and of in-service education. New achievement tests are to be constructed. Data will be drawn on validation of attitude scales against behavior and relation of teacher characteristics to effectiveness. Some data will be gathered from other regions as well. As regards teachers, the purpose is evaluation of the effectiveness of curricula under various conditions of use and qualifications of staff, and not the evaluation of teachers. In-service education will be conducted through correspondence and perhaps also through film or television. The project will probably continue for four years.

**Sources of Further Information.**

*SMSG Newsletter* No. 2 (out of print) and 10; bulletins and reports to be published by the Minnesota National Laboratory. Further information is available from the project director.

**See also**

- 8. SYRACUSE UNIVERSITY-MORETOR COLLEGE MADISON PROJECT
- 9. COORDINATED SCIENCE AND MATHEMATICS CURRICULUM FOR GRADES K-6
- 27. ACTIVITIES OF THREE PLAN COMMITTEES, II
- 101. EXPERIMENTAL PLANS IN MATHEMATICS
- 104. COMMITTEE ON THE UNDERGRADUATE PROGRAM IN MATHEMATICS (CUPM)
- 105. EXPERIMENTAL TEACHING PROGRAM IN ALGEBRA
- 107. POWER SERIES AND THE ELEMENTARY FUNCTIONS
- 110. COURSE IN MATHEMATICS FOR PROSPECTIVE JUNIOR HIGH SCHOOL TEACHERS

# G. Meteorology

**34. MONOGRAPH SERIES ON METEOROLOGY.** (*Secondary, College*) KENNETH C. SPENGLER, American Meteorological Society, 45 Beacon Street, Boston 8, Massachusetts. (1960– )

A series of monographs on meteorology and related fields will be aimed for high school and college students who are interested in science. Subjects tentatively selected include Satellites, Meteorological Experiments, Oceanography, Advection, Planetary Atmospheres, Cloud Physics, Hurricanes, Ozone and Upper Atmosphere, Weather Forecasting, General Circulation, Atmospheric Models, Jet Stream, Climatology, Turbulence.

**Sources of Further Information.**

Information on the current status and availability of materials within its educational services is available from the Society.

**35. MOTION PICTURES AND LANTERN SLIDES IN METEOROLOGY.** (*Secondary, College*) KENNETH C. SPENGLER, American Meteorological Society, 45 Beacon Street, Boston 8, Massachusetts. (1960– )

Development of a comprehensive series of educational motion pictures, filmstrips and slides designed to present the nature and scope of meteorology as the science of the atmosphere is being undertaken. One film will be an overview with emphasis on the effects of weather and climate on mankind. A set of films and filmstrips is planned for secondary school classroom use to correlate with and add depth and interest to the meteorology portions of current general and earth science curricula. Highly technical material related to experimental meteorology, cloud physics, and other advanced areas of meteorology difficult to demonstrate in the laboratory will be the basis of films and film slides for use in meteorological curricula in universities. An industrial film in which the interactions of weather, climate, and industry are highlighted will show the significance of applications of meteorological knowledge and their economic impact. For programing on educational television,

use by schools and civic groups, a set of films on subjects of topical interest will be considered to include hurricanes, tornadoes, air pollution, cloud modification, etc.

**Sources of Further Information:**

Information on the current status and availability of materials within its educational services are available from the Society.

## H. Physics

**36. PHYSICAL SCIENCE STUDY COMMITTEE (PSSC).** *(Secondary, College)* JERROLD R. ZACHARIAS, Department of Physics, Massachusetts Institute of Technology, Cambridge 39, Massachusetts. (Grantees: Massachusetts Institute of Technology, 1957–59; Educational Services Incorporated, 164 Main Street, Watertown 72, Massachusetts, 1960– )

The course consists of a new textbook, published in a hardcover edition, a set of some 35 films carefully integrated with the text, a series of paperback monographs, special laboratory experiments and inexpensive apparatus kits, a laboratory guide, special tests, and a teacher's guide. All are commercially available. In the academic year 1961–62, the course was taught by some 1,800 teachers to about 72,000 students throughout the country. The course attempts to present physics as physics appears to contemporary physicists, as a unified but unfinished story and as an activity carried on by human beings as part of the general intellectual history of mankind. Through its emphasis upon laboratory experimentation, the course seeks to encourage the student's spirit of inquiry. Physical laws are not asserted; they are, it is hoped, discovered by the student.

Part I of the course deals with matter, time, and space; Part II with light; Part III with motion; and Part IV with the nature of electrical forces and energy. The course is aimed at those students whose abilities would normally lead them to take high school physics.

PSSC is currently engaged in producing more films for the course and more monographs for the Science Study Series, in further research on testing, and in the creation of a course in advanced topics for advanced standing high school students and for liberal arts colleges. (See 37. PHYSICAL SCIENCE STUDY COMMITTEE—ADVANCED TOPICS.) This program, like PSSC, will include text material, films, laboratory experiments, equipment and guides, a teacher's guide and tests.

**Sources of Further Information:**

Gilbert C. Finlay, "The Physical Science Study Committee," *The School Review* 70, 63 (Spring 1962).

Further information is available from Educational Services Incorporated. Text, teacher's guide, and lab guide are available from D. C. Heath and Company, 285 Columbus Avenue, Boston 16, Massachusetts. Films are distributed or rented by Modern Talking Picture Service, Inc., 3 East 54th Street, New York 22, New York. Monographs are distributed in trade and school editions by Doubleday and Company, Inc., 575 Madison Avenue, New York 2, New York. A number of apparatus manufacturers now distribute equipment suitable for use in the PSSC course. Examinations are available from the Educational Testing Service, Princeton, New Jersey.

**37. PHYSICAL SCIENCE STUDY COMMITTEE—ADVANCED TOPICS.** *(Secondary, College)* URI HABER-SCHAIM, Educational Services Incorporated, 164 Main Street, Watertown 72, Massachusetts. (1962–1963)

The course materials consist of text, laboratory guide, teacher's guide, and apparatus kits for six chapters which go beyond the basic PSSC course, the content of which is described in item **36**. The topics included are angular momentum, relativity, statistical mechanics, and quantum physics. The new materials are intended to be used in high schools offering either a third semester of physics or advanced standing courses in physics, and in colleges using the PSSC text for freshman physics courses or wishing to supplement their present courses with materials in the spirit of the PSSC course. Sixty experienced PSSC teachers and several college physics teachers will try out the advanced topics in a pilot study during the 1962–63 school year. "Weekend institutes" will be held in four centers to acquaint the teachers with the new materials.

**Sources of Further Information:**

The printed material is being prepared for separate distribution at first with the possibility of being incorporated into the PSSC course later. Preliminary copies of Chapter A-1, "Angular Momentum and its Conservation," and a laboratory guide with three experiments on angular momentum, four on relativity, and two on the

spectrum of hydrogen and helium are now available. Preliminary copies of additional chapters and laboratory experiments will become available during the 1962–63 school year. Orders for preliminary copies of the printed materials should be sent to Mr. Sturtevant Hobbs, D. C. Heath and Company, 285 Columbus Avenue, Boston 16, Massachusetts. Additional information may be obtained by writing to Educational Services Incorporated.

See also:
127. SHORT FILMS IN PHYSICS

# III. TECHNICAL INSTITUTE PROJECTS

**38. GUIDELINES FOR TECHNICAL INSTITUTE EDUCATION.** JAMES L. MCGRAW University of Dayton, Dayton 9, Ohio. (Grantee: American Society for Engineering Education, University of Illinois, Urbana, Illinois.) (1961–1962)

The principal objective of this project is to recommend minimum educational standards for curricula designed to educate students for employment as engineering technicians. The final report should serve as a guide to the development of such curricula by educational institutions. The project will evaluate data accumulated over the past 15 years but is not a survey of the existing situation; it does not duplicate the National Survey of Technical Institute Education (carried out by the American Society for Engineering Education in 1959 under the direction of G. Ross Henninger). In view of the confusion of terminology associated with technical education and engineering technicians, the project has also given attention to definitions and terminology within this field of education. The study is developing educational standards in such areas as faculty, admission requirements, mathematics, physical science, communications, humanistic-social studies and, of course, the technical portions of the curricula. Course outlines are not a part of this project. A preliminary report will be reviewed by a large sample of schools of all types offering technical curricula, industries employing technicians, and government agencies.

**Sources of Further Information:**

The final report will be available from the American Society for Engineering Education at the address given above, in the fall of 1962.

# IV. COLLEGE AND UNIVERSITY PROJECTS

## A. Agriculture

**39. COMMITTEE ON EDUCATIONAL POLICY IN AGRICULTURE.** H. BURR STEINBACH, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, N. W., Washington 25, D. C. (1962–1965)

The broad purpose of this project is to foster improvement in education in the agricultural sciences by providing universities with guidelines for developing curricula based upon contemporary science. The work will be carried out by a committee of agricultural scientists drawn from universities, industry, and Government, under the chairmanship of A. E. Darlow, Dean of Agriculture at Oklahoma State University. The committee will invite many agricultural scientists and organizations concerned with the discipline to contribute to the work. The study will include an investigation of education appropriate for the different types of talent needed in contemporary agricultural research and practice, development

of suggestions on university curricula, and consultative assistance to universities in developing instructional programs based upon the committee's study.

**Source of Further Information:**

Information on the project can be obtained from Dr. A. E. Darlow, Dean of Agriculture, Oklahoma State University, Stillwater, Oklahoma

# B. Anthropology

**40. EDUCATIONAL RESOURCES IN ANTHROPOLOGY.** DAVID G. MANDELBAUM, Department of Anthropology, University of California, Berkeley 4, California. (1959–1962)

This project has made a general survey of the teaching of anthropology and has compiled bibliographic and other materials for use in teaching at the college level. A series of ten conferences on anthropological teaching was held, and the papers prepared for these symposia were later revised for publication by the authors. Fifty-five papers are now ready for publication, arranged in the following sections of the completed manuscript:

*Volume I. The Teaching of Anthropology*

Introduction: The Transmission of Anthropological Culture
I. The Undergraduate Curriculum in Anthropology
II. The Teaching of Physical Anthropology
III. The Teaching of Cultural and Social Anthropology
IV. Courses on Regions and Civilizations
V. The Teaching of Archeological Anthropology
VI. The Teaching of Linguistics and Anthropology
VII. The Teaching of Applied Anthropology
VIII. Graduate Training
IX. Relations with Other Subjects and Curricula
X. Academic Environments in the Teaching of Anthropology
XI. Perspectives on Anthropological Teaching

*Volume II. Resources for the Teaching of Anthropology*

Introduction
I. A Survey of Catalog Listings in Anthropology
II. Student Enrollments and Teachers of Anthropology in California
III. Personnel Resources: Building the Anthropology Department
IV. The Use of Audio-Visual Teaching Aids
V. Teaching Aids in Physical Anthropology
VI. Library Problems in the Teaching of Anthropology
VII. A Basic List of Books and Periodicals for College Libraries

**Sources of Further Information:**

Two volumes will be issued as a memoir of the *American Anthropologist* and will also be published in a hard-cover edition by the University of California Press. The books will appear late in 1962 or early in 1963.

**41. VISUAL ANTHROPOLOGY—MOTION PICTURES AS APPLIED TO RESEARCH AND TEACHING.** *(College, Graduate School)* J. O. BREW, Director, Peabody Museum, Harvard University, Cambridge 38, Massachusetts. (1959– )

The establishment of the Film Study Center in the Peabody Museum, Harvard University, arose from the conviction that only a very small percentage of the possibilities of the use of the motion picture in research and teaching had been utilized. The Film Study Center was established as an experimental unit to develop new uses of film in teaching and research.

Work under this grant can be summarized under three headings:

1. A course on Representational Methods in Anthropology was designed to introduce students to the possibilities of the use of light and sound in scientific work. Each member of the course makes a motion picture. Films include *Orange and Blue;* a film on the University of Pennsylvania's excavation at the prehistoric Maya site of Tikal in Guatemala, at present in production; one dealing with the famous Neolithic Bronze and Iron Age Rock Carvings in Camonica Valley in Italy (cf. Emanuel Anati, *Camonica Valley,* Alfred A. Knopf, New York, New York, 1961), to be released soon.

2. Continued experimentation and production involving more than 500,000 feet of 16-mm color motion picture film taken during eight expeditions to Southwest Africa (1950–1959) which show a large part of the culture of a band of

!Kung Bushmen and considerable additional footage of other Bushmen groups for comparative purposes. The films obtained by the Marshall-Peabody Museum-Smithsonian Expedition in the Kalahari Desert of Southwest Africa realize an often-discussed possibility, namely, an ethnography on film. The first product of this work, *The Hunters*, has won a number of awards here and abroad. Although the original production plan called for four to six more long films similar to *The Hunters* and fifteen to twenty short films reproducing basic themes and techniques of !Kung Bushmen life, more exciting experimental techniques are now being developed. It is proposed to make from the Center's great reservoir of Bushmen film, including everything from technology to marriage, stillbirth, curing ceremonies and death, a series of sequences which will permit the course instructor in anthropology to present to his class something similar to the experience the student would have if he were observing the events in the field.

3. The production of a film based on 50,000 feet of film taken by the 1961 Peabody expedition to a group of completely unacculturated native villages in the Grand Valley of the Baliem in the central mountain area of Western New Guinea. Inasmuch as the focal institution in Dani society is organized warfare with traditional enemy groups, it is with aggression and its consequences that the film will be primarily concerned. The basic continuity will follow exactly the course of events as they transpired during the time the expedition was in the field. It is, to the best of the director's knowledge, the first time that primitive warfare will be shown with detail and authenticity.

**Sources of Further Information:**

"Film Study Center," *Harvard Alumni Bulletin* (December 13, 1958).

Robert Gardner, "Anthropology and Film," *Daedalus: Proceedings of the American Academy of Arts and Sciences*, 86, 344 (1957).

A duplicated description of the film course is avialable from the Department of Anthropology, Harvard University.

*The Hunters* is distributed by Contemporary Films, Inc., 267 West 25th Street, New York 1, New York.

Further information on the course and other films may be obtained from the project director as well as the following: Mr. Robert Gardner, Director, and Mr. John K. Marshall, Assistant Director for the Bushman Project, Film Study Center of the Peabody Museum. The Center will be glad to give advice to prospective film makers.

**42. HISTORIC FILMS ON AMERINDIAN ETHNOLOGY.** *(College, Graduate School)* FREDERICK J. DOCKSTADER and CARMELO GUADAGNO, Museum of the American Indian, Heye Foundation, Broadway at 155th Street, New York 32, New York. (1960– )

The primary objective of this project was to preserve motion and still pictures on the ethnology of American Indians by transferring perishable negatives to safety film. The films are documentary in character. They record technologies and ceremonies, with particular emphasis on obtaining a photographic record of all the steps involved in a given process or activity. They record aspects of the lives of a number of tribes of American Indians, particularly peoples of the Plains and the Southwest. In most cases, the original films were taken during the period from 1910 to 1925; consequently, they often record events which no longer can be duplicated.

The first aim of the project was to transfer these fundamental records to film stock which would assure relative permanence. The basic record would thus be available for the production of specific films for both educational and research purposes. In addition, a comprehensive catalog of the films has been prepared so that people interested in research and teaching may know what is available.

**Sources of Further Information:**

When the project is completed, the Heye Foundation will publish (1) a comprehensive report on the project, and (2) a catalog of motion and still films available.

**43. AMERICAN INDIAN FILMS.** *(Secondary, College)* S. A. BARRETT, Department of Anthropology, University of California, Berkeley 4, California. (1961– )

The project has for its purpose the recording of the arts, crafts, ceremonies, and rituals of the Indian tribes of Western America in color motion pictures and with sound recordings. These records of such rapidly vanishing customs will be most useful in research and teaching in many disciplines in addition to anthropology.

From these recorded films and tapes are produced a series of sound-color films for use as

teaching aids in college and secondary-school classes. They are available to any institution or organization where no admission is charged for their showing. With the rapid cultural changes taking place everywhere and the complete disappearance of the Indian's old way of life, films like these are the only adequate means of studying Indian customs as they existed before the coming of the white man. Such films transform the classroom into a laboratory and provide the student with an opportunity for direct, personal observation, something quite impossible under the changed conditions of life in the Indian villages today.

Where a custom is still in use, it is recorded in detail as it is found. However, it is often necessary to reconstruct some old process which is no longer used but which is recalled in detail by some very old tribesman. Days or even weeks may be spent procuring the authentic materials, and many hours may be required for photographing the re-enactment of the process itself. Not infrequently, this information and re-enactment comes from the sole survivor who knows all the details of the subject. When he is gone, the last knowledge of the subject disappears, except for the film which forms a permanent record available to anyone who wishes to study it. The initial series of films (sound-color, 16 mm, accompanied by appropriate Indian songs) includes the following:

*Basketry of the Pomo, Introductory Film* (33 minutes). The art of basket-making reached its climax among the Pomo Indians of Northern California. The film gives an over-all introduction to Pomo basketry, showing women gathering and preparing their basket-making materials, weaving techniques, and basketry uses, forms, and ornamentation.

*Basketry of the Pomo, Techniques* (33 minutes). The ten ancient techniques involved in Pomo basket-making shown in slow motion and simplified drawings; of particular value to persons interested in the textile and decorative arts.

*Basketry of the Pomo, Forms and Ornamentation* (22 minutes). Detail, treatment of forms and ornamentation of Pomo basketry, depicting basic design elements and intricate combinations of patterns, tribal mythology and taboos which influence particular phases of basketry; and many of the Pomos' finest baskets are shown, including the magnificent feather baskets and the rare "sun basket."

*Acorns, Gathering, Storing, and Processing as Done by the Southwestern Pomo Indians of California* (28 minutes). Methods used by Indians residing in the Redwood Belt to prepare tan oak acorns, their staple food.

*The Game of Staves, as played by the Southwestern Pomo Indians of California* (10 minutes). Pomo boys playing the game of staves as played by most of the Indian tribes throughout North America.

*The Sinew-Backed Bow and Its Arrows,* as made by the Yurok Indians (24 minutes). The art of making the sinew-backed bow and its arrows is remembered by only a single member of the Yurok Tribe. Illustrates the painstaking technique and the care taken by these craftsmen, who achieved unequalled strength and accuracy in their weapons.

*Buckeyes, a Food of the California Indians* (13 minutes). A Nisenan Indian demonstrating an ancient method, unique to the Indians of California, for preparing from the poisonous buckeye, or horse chestnut, a nourishing staple, comparable in food value to the potato.

*Pine Nuts, a Food of the Paiute and Washo Indians of California and Nevada* (13 minutes). Processing of nuts of the piñon tree by Paiute tribesmen to produce a staple food used by Indians since pre-Columbian times.

Additional films which should be available shortly include: (1) *The Tule Balsa* (Southeastern Pomo); (2) *Ceremonial Dances of the Southwestern Pomo, Men's Dances;* (3) *Ceremonial Dances of the Southwestern Pomo, Women's Dances;* (4) *Box Making* (by wood bending), Kwakiutl Indians of British Columbia; (5) *Totem pole Carving,* Kwakiutl Indians of British Columbia; (6) *Hamatsa Dances,* Kwakiutl Indians of British Columbia; (7) *Arrowhead Making,* Tolowa Indians of California.

**Sources of Further Information:**

These films are available through the Department of Visual Communications, University Extension, University of California, Berkeley 4, California.

**44. FILMS OF EXCAVATION AND FINDINGS ON THE OLMEC SITE IN LA VENTA, MEXICO.** ROBERT F. HEIZER, Department of Anthropology, University of California, Berkeley 4, California. (1962–1963)

The 1955 expedition to La Venta, Tabasco, Mexico, was the first to conduct a large-scale

excavation which yielded evidence suggesting that the Olmec culture was one of the earliest high cultures to develop in Mesoamerica. In view of the archeological importance of this prize site, every means of communicating the facts of the culture and their significance is highly desirable. During the 1955 expedition, a certain amount of motion picture footage was obtained and some 800 color transparencies were taken, many of which lend themselves to reproduction on motion picture film. From these materials, plus additional motion picture photography, a film will be made showing archeological technique, interpretation of stratigraphy, and facts about the Olmec culture as known from the site of La Venta. This motion picture will serve to provide information in a unique and meaningful manner to a much wider audience than has access to the publications at present available on the subject. This audience would include college and university students, as well as professional archeologists who so far have known the La Venta excavation only through books or still pictures. By means of the visual materials already described, and with the use of full animation techniques, this significant find can be visually recorded and preserved. It should be noted that the La Venta Site is now badly disturbed so that no further excavations can be conducted in the central area. The available materials, supplemented by additional photography as described, offer the sole means of making a motion picture record of the operation.

**Sources of Further Information:**

Detailed monograph reports of the 1955 expedition. "Excavations at the La Venta, Tabasco, 1955," by P. Drucker, R. F. Heizer, and R. J. Squier, *Bureau of American Ethnology Bulletin 170* (1959), are available from the project director.

*See also:*
14. FILM SERIES: "SCIENCE UNDER PRESSURE: ARCHEOLOGICAL SALVAGE IN THE UNITED STATES"

# C. Biology

**45. COMMITTEE ON EDUCATIONAL POLICIES IN BIOLOGY.** *(Secondary, College, Graduate School)* HOWARD M. PHILLIPS, JR., Alabama College, Montevallo, Alabama. (Grantee: National Academy of Sciences-National Research Council, 2101 Constitution Avenue, N. W., Washington 25, D. C.) (1954–1959)

The Committee on Educational Policies was established within the Division of Biology and Agriculture of the National Academy of Sciences in 1954 to make a concerted and thorough study of education as related to the biological sciences in elementary and secondary schools and in colleges and universities. The committee consisted of Dr. Phillips; Dr. Herbert R. Albrecht, Pennsylvania State University; Dr. Clyde H. Bailey, University of Minnesota; Dr. Claude S. Chadwick, Peabody College for Teachers; Dr. Thomas S. Hall, Washington University; Dr. Milton O. Lee, Federation of American Societies for Experimental Biology; Dr. Theophilus S. Painter, University of Texas; and Dr. Paul A. Weiss, Rockefeller Institute. Subcommittees, each chaired by a member of the committee, were established in the areas of precollege education, college education, applied biology and technical specialists, graduate and professional education, adult education, and publications and instructional materials. During its four-year term, the committee worked in cooperation with a large number of professional societies, Government agencies, private foundations, and educational institutions and drew upon contributions from more than 1000 biologists. The committee attempted to define problems and promising solutions for them with the hope that the analyses and suggestions developed by the committee would prove useful to biologists, colleges and universities, and professional groups in mounting action programs. The committee also carried out a few projects as experiments and pilot operations. During much of its term, the committee was closely associated with the Biology Council of the Division of Biology and Agriculture. The committee published a large number of special reports for limited circulation, as well as a few formal reports which are listed below. Support was provided by grants from the Rockefeller Foundation and the National Science Foundation.

**Sources of Further Information:**

The following publications of the National Academy of Sciences-National Research Council:

*Biological Materials: Part I, Preserved Materials and Museum Collections*, 20 pp., Publication 399 (1956).

*Instrumentation in Bio-Medical Research*, 14 pp., Publication 472 (1957).

*Improving College Biology Teaching*, 70 pp., Publication 505 (1957).

*Biological Education: A Partial Bibliography*, 159 pp., Publication 518 (1957).

*Recommenations on Undergraduate Curricula in the Biological Sciences*, 86 pp., Publication 578 (1958).

"Suggested Outline for Teaching Systematic Botany," *Plant Science Bulletin* 4, 1 (1958).

"An Approach Toward a Course in the Principles of Parasitism," *Journal of Parasitology* 44, 28 (1958)

C. A. Lawson and R. E. Paulson, eds., *Laboratory and Field Studies in Biology: A Source Book for Secondary Schools*, Holt, Rinehart and Winston, Inc., New York, New York (1960) (Teacher and student editions)

**46. SOURCEBOOK OF LABORATORY EXERCISES IN PLANT PATHOLOGY.** ARTHUR KELMAN, Department of Plant Pathology, North Carolina State College, Raleigh, North Carolina. (1959– )

The sourcebook project sponsored by the Committee on Teaching of the American Phytopathological Society is designed to serve two purposes: (1) to assemble in an organized fashion the best exercises currently in use for the teaching of plant pathology in the United States, and (2) to stimulate the development of new exercises for use in introductory courses in plant pathology as well as in closely related fields. In addition, it is hoped that the availability of effective and stimulating teaching material will facilitate presentation of this area of microbiology in college botany courses as well as in general courses in biology. Since teachers of plant pathology, unlike research workers, have few opportunities to record the original ideas and effective techniques that they have developed in their own teaching, it is hoped that the recording of superior studies in this sourcebook will help to give proper recognition to the teachers who prepared them.

Furthermore, in order to fulfill the objectives of the sourcebook, research pathologists who are authorities in given areas were asked to develop new demonstration or student participation exercises which would illustrate basic concepts in plant pathology and also incorporate the recent significant advances in this area of biology. In this way, exercises have been obtained that present the significant developments in plant pathology within the scop. of demonstrations and laboratory work. The first draft, containing 207 exercises with appropriate indexes and supplemental material, was released for trial and review in May 1962. By 1964 a revised version, modified as a result of classroom trial, will be made avilable.

**Sources of Further Information:**

Further information can be obtained from the project director.

**47. LABORATORY EXPERIMENTS IN GENERAL PHYSIOLOGY.** SAMUEL R. TIPTON, Department of Zoology, University of Tennessee, Knoxville, Tennessee. (Grantee: American Physiological Society, 9650 Wisconsin Avenue, Washington 14, D. C.) (1959–1960)

This is a compilation of selected, tested laboratory experiments in general physiology for college use. The intention is not to provide a complete college laboratory course but rather to offer selected experiments to supplement or replace standard experiments that may now be in use. This allows teachers to compile their own laboratory courses. There is no effort to duplicate widely used, traditional experiments that can be secured from published laboratory manuals. The experiments have been collected from experienced teachers of general physiology, tested in the class laboratory, and reviewed and edited by a committee of experts. The series of experiments will be revised from time to time and will be available on a continuing basis.

**Sources of Further Information:**

Mimeographed copies of experiments are available at $1.30 per set from Dr. Ray G. Daggs, Executive Secretary, American Physiological Society.

**48. SHORT FILMS IN MICROBIOLOGY.** *(College, Medical School, Secondary)* DONALD M. REYNOLDS, Department of Bacteriology, University of California, Davis, California. (1959–1961)

The University of California, Davis campus, has produced a series of short 16-mm teaching films primarily for college, graduate and medical school instruction in microbiology; much of the material is also suitable for secondary school teaching. These films are brief, and each emphasizes a single phenomenon or concept; they are designed to be used in lieu of still projection slides without disturbing the pace or pattern of lectures. In the first series, fifteen films were made from "clips" taken from longer productions originally produced by

various organizations, and three were prepared by the university group. Films currently available are listed below. As a result of their experiences in this project, a large group of the nation's leading microbiologists plan to develop a series of short motion pictures for use in the teaching of microbiology at college and secondary-school levels.

The following films are now available from sources listed at the end of this report.

1. *The Development of Bacteriophage Plaques*, sound, black-and-white, 1½ minutes, rental $1.50, sale $15.50. Time-lapse study of the attack on the bacterial carpet growing in a Petri dish by bacteriophage.

2. *The Life Cycle of a Bacteriophage* (animation), sound, black-and-white, 1 minute, rental $1.50, sale $17.00. A virus particle attacks a host bacterial cell and replicates; its progeny are released as the cell bursts.

3. *Phagocytosis*, sound, black-and-white, 3½ minutes, rental $1.50, sale $22.00. Phase contrast, time-lapse cinemicrography showing ingestion of both dead and live streptococci.

4. *Rabies in a Human Patient*, sound, black-and-white, 4 minutes, rental $2.00, sale $25.00. Clinical symptoms shown in an Iranian patient as the disease proceeds through its course.

5. *The Spread of Typhus*, sound, black-and-white, 2 minutes, rental $1.50, sale $19.00. How the louse transmits typhus.

6. *Cholera*, sound, color, 3 minutes, rental $2.50, sale $42.75. Public health background and clinical course of the disease in India.

7. *Clinical Aspects of Chicken Pox (Varicella)*, sound, color, 1½ minutes, rental $1.50, sale $21.00. Clinical symptoms of the disease.

8. *Clinical Aspects of Leprosy*, sound, color 4 minutes, rental $2.50, sale $34.25. Clinical symptoms, filmed at Carville, Louisiana, Leprosarium of the U. S. Public Health Service.

9. *Clinical Aspects of Tetanus*, sound, color, 2 minutes, rental $2.00, sale $25.50. Clinical symptoms.

10. *Measles (Rubeola) in Children*, sound, color 1½ minutes, rental $2.00, sale $24.25. Clinical symptons.

11. *Surgical Removal of Lesions in Pulmonary Tuberculosis*, sound, color, 2½ minutes, rental $2.50, sale $31.00. Lung resection on a living patient and dissection of a tubercular nodule. Originator of film does not wish it shown to below college level or lay audiences.

12. *Pharmacological Testing of New Antibiotic Agents*, sound, color, 1½ minutes, rental $2.00, sale $25.50. Beneficial chemotherapeutic as well as toxic effects in experimental animals.

13. *Production of Poliomyelitis Vaccine*, sound, color, 12 minutes, rental $6.50, sale $122.00. Preparation of formaldehyde-inactivated vaccine at a pharmaceutical plant.

14. *The Effect of Poliomyelitis Virus on Human Epithelioid Cells*, sound, color, 5 minutes, rental $3.00, sale $55.00. Normal and virus-infected cultures are shown in time-lapse cinemicrography with the interference microscope.

15. *The Life Cycle of the Malaria Parasite* (animation), sound, color, 11½ minutes, rental $6.50, sale $124.00. Sexual and asexual cycles, including exoerythrocytic stages, are depicted, in part by animation techniques.

16. *Anaphylaxis in Guinea Pigs*, sound, color, 7½ minutes, rental $4.50, sale $91.00. Demonstration of the symptoms of anaphylactic shock in the guinea pig. Animals sensitized with egg albumen shown along with unsensitized control.

17. *The Complement Fixation Test* (animation), sound, color, 5 minutes, rental $2.00, sale $55.00. Animated film using symbols to show the antigen-antibody-complement reactions in both positive and negative tests.

18. *The Rumen Ciliate Protozoa*, sound, black-and-white, 8-10 minutes (estimated—still in production), rental about $3.00, sale about $55.00. A cinemicrographic study showing morphology, motility and feeding of various species of these organisms.

**Sources of Further Information:**

For information on present distribution sources, please write to the following:

*For rental and purchase:* Educational Film Sales, University of California Extension, Berkeley 4, California (preview prints of single films or entire series available).

*For information on content and use:* Professor Donald M. Reynolds, Department of Bacteriology, University of California, Davis, California.

*For rental only:* Dr. R. W. Sarber, Executive Secretary, American Society for Microbiology, 19875 Mack Avenue, Detroit 36, Michigan.

**49. AN INTRODUCTION TO MODERN BIOLOGY ("THE NATURE OF LIVING THINGS").** George Wald, Department of Biology, Harvard University, Cambridge 38, Massachusetts. (1960–1963)

This is a one-year course, designed both for general education and for students continuing in the sciences, including pre-medical students. The course consists of three lectures per week and one afternoon of laboratory throughout the year. An attempt is made in lectures to present a unified approach, beginning with elementary particles and a little cosmology, and working up through higher and higher levels of organization until one comes to living organisms. The treatment of the lower levels of organization, beginning with elementary particles, builds up to the atoms and the periodic system, discusses forces of chemical combination and molecules (specifically those molecules of importance to organisms), and culminates in the macromolecules. The discussion is based throughout on the structures, and students are introduced early to making molecular models for themselves. After such a structural consideration of macromolecules and viruses, students are sufficiently well prepared to consider the main processes of cellular metabolism: fermentation, respiration, photosynthesis. With this they proceed to the cell, and from there develop biology as such. Having approached living organisms by this route, all further matters—morphology, genetics, physiology, and evolution—are discussed at the molecular level whenever that is appropriate.

The laboratory begins at once with living organisms and is biological throughout. It includes three weeks' work in microbiology with bacteria and bacteriophage and also two weeks of electrophysiology.

**Sources of Further Information:**

A new laboratory manual written for the course and entitled *Twenty-six Afternoons of Biology* will be published in 1962 by the Addison-Wesley Company, Reading, Massachusetts. Further information is available from the project director.

**30. LABORATORY COURSE IN INSTRUMENTATION.** *(College, Graduate School)* K. S. Lion, Department of Biology, Massachusetts Institute of Technology, Cambridge 39, Massachusetts. (1960–1963)

The general objective of this project is the development of a broad, thorough, and efficient laboratory course in instrumentation and physical research methodology. A working familiarity with the principles of modern instrumental methods is now essential for investigators in most scientific fields. The course is designed for graduate and post-graduate students in the biological and medical sciences but is also suitable for students in the physical sciences and engineering. The course begins at an elementary level with the design of simple, but increasingly more complex, electric circuits and leads through a sequence of carefully selected classical and modern methods to electronic systems and computers. The course is designed for a term of 15 weeks but can be taken for single (4-hour) or double (8-hour) credit. Provisions are made to use the same equipment in intensified summer seminars for research workers and instructors who either want to become familiar with modern instrumentation or who would like to install similar courses in their institutions.

**Sources of Further Information:**

A course description including the laboratory notes for the students will be compiled toward the end of this project and will be made available as a technical report to the scientific community. Visitors are invited to inspect the laboratory. Further information may be obtained from the project director.

**31. EDUCATION IN WOOD SCIENCE AND TECHNOLOGY.** George A. Garratt, School of Forestry, Yale University, New Haven, Connecticut. (Grantee: Society of Wood Science and Technology.) (1960–1962)

The study encompasses a survey of the present status of professional education in wood science and technology and recommendations for the future. It is intended to provide the information and incentive needed for professional upgrading and particularly for enhancement of education in wood science and technology through strengthening the scientific bases on which the profession rests.

Specific objectives of the study are:

1. To consider the problems of adequate staffing of educational departments that offer professional training in the field, particularly from the standpoint of additional education needed by staff members to enable them to handle the basic science aspects of their work more adequately.

2. To set goals regarding curriculum requirements for professional training on an over-all basis and in specialized areas.

3. To make recommendations regarding the proper balance between courses in the basic areas of biological studies of wood, wood chemistry,

wood physics, and wood engineering, and in the applied areas of wood processing, the wood-using industries, and forestry.

4. To offer guidance regarding prerequisite sub-professional courses in the underlying sciences and in the humanities.

5. To aid in the establishment of a uniform system of course names and definitions and of standards of course content and quality.

6. To point out, where necessary, the needs for additional course outlines, textbooks, laboratory manuals, and other teaching aids.

**Sources of Further Information:**

Further information may be obtained from the project director and from the following officers of the Society of Wood Science and Technology: Dr. Robert L. Youngs, Forest Products Laboratory, Madison, Wisconsin; Dr. Everett L. Ellis (Executive Secretary), Department of Wood Technology, University of Michigan, Ann Arbor, Michigan; Mr. Henry Haskell (Secretary), Society of Wood Science and Technology, P. O. Box 2004, Madison 5, Wisconsin.

**32. WOOD-MOISTURE RELATIONS.** WILLIAM M. HARLOW and CHRISTEN SKAAR, Wood Products Engineering Department, State University College of Forestry at Syracuse University, Syracuse 10, New York. (1960–1961).

This 16-mm film will endeavor to make clear some of the mechanisms of moisture movement in wood. Animation and time-lapse photography are being used, as well as normal speed recording of the behavior of wood as it shrinks and swells with changes in moisture content. The proper utilization of wood by engineers and architects depends upon a knowledge of wood-moisture relations. The film is in sound and color, and runs 30 minutes.

**Sources of Further Information:**

This film will be distributed by the film library of the State University College of Forestry at Syracuse University.

**33. FILM SERIES. "THE PROMISE OF THE LIFE SCIENCES".** *(College, Graduate School)* JOHN B. HOLDEN, Graduate School, U. S. Department of Agriculture, Washington 25, D. C. (1960-1961).

In five 16-mm sound, black-and-white films, five distinguished scientists tell about advances at the frontiers of research in the biological sciences and report spectacular gains made in the broad range of the life sciences.

1. *Biological Transformation of Energy*, A. Szent-Gyorgyi, Woods Hole Marine Biological Laboratory, 54 minutes, 2 reels. Progress in research to find how life uses electronic energy from the sun to build and drive living systems.

2. *Genetics*, George Beadle, President, University of Chicago, 53 minutes, 2 reels. Recent advances in our understanding of how all living creatures from sub-microscopic viruses to man himself transmit biological specifications to their offspring.

3. *Nutrition—The Chemistry of Life*, Jean Mayer, School of Public Health, Harvard University, 58 minutes, 2 reels. The search to discover what regulates normal appetites and the causes of obesity.

4. *Fine Structure and Pattern of Living Things*, Paul Weiss, The Rockefeller Institute, 50 minutes, 2 reels. New understanding of the organization of living systems into primary patterns and the changes and distortions that come with secondary growth.

5. *The Organism and the Environment*, Arthur D. Hasler, University of Wisconsin, 57 minutes, 2 reels. Recent advances in our understanding of interaction in nature as shown by the distribution of plants, competition between populations of beetles, and the migration of fishes.

**Sources of Further Information:**

The films can be purchased or rented from the Graduate School, U. S. Department of Agriculture, Washington 25, D. C. The rental fee is $10 per film; the purchase price is $120 per film, $550 for the set of five. Video tapes have been made available to the National Educational Television and Radio Center, 2320 Washtenaw Avenue, Ann Arbor, Michigan. They will service the educational television stations. To supplement the films, the Graduate School has published these lectures in a 78-page, paper-bound booklet. It will serve as a valuable study aid. The publication is available from the Graduate School, U. S. Department of Agriculture, for $1.50.

Films are available at the following film libraries: University of Arizona, Visual Aids Bureau, Tucson, *Arizona;* University of California Extension, Department of Visual Education, Berkeley, *California;* Audio-Visual Service, Colorado State University, Fort Collins, *Colorado;* Georgia Agricultural Extension Service, Athens,

*Georgia;* School Film Library Services, College of Education, University of Kentucky, Lexington, *Kentucky;* Visual Aids Service, University of Illinois, Champaign, *Illinois;* University Extension Bureau of Visual Instruction, University of Kansas, Lawrence, *Kansas;* Michigan State University, Audio-Visual Center, East Lansing, *Michigan;* University of New Hampshire, Audio-Visual Center, Durham, *New Hampshire;* Extension Service, College of Agriculture, South Dakota State College, Brookings, *South Dakota;* State Department of Education, Audio-Visual Division, Columbus 15, *Ohio;* University of Texas, Division of Extension, Visual Instruction Bureau, Austin, *Texas;* University of Wisconsin, Bureau of Audio-Visual Instruction, Extension Division, Madison, *Wisconsin.*

**54. TELEVISION COURSE ON "THE NEW BIOLOGY."** JOHN W. TAYLOR, Learning Resources Institute, 10 Columbus Circle, New York 19, New York; RAY KOPPELMAN, Department of Biochemistry, The University of Chicago, Chicago 37, Illinois. (Grantee: Learning Resources Institute; cosponsor: American Institute of Biological Sciences.) (1961-1962)

This television course was designed to help improve the teaching of biology in the nation's secondary schools and colleges. The content reflects the striking advances in biological research in recent years. Science teachers, particularly those who teach biology, can thereby acquaint themselves with new developments in biology and enrich their own teaching. The principal instructor was Dr. Ray Koppelman, assisted by an advisory group of eminent biologists, including Professor Vernon Cheadle, University of California, Davis; Dr. John Bodel, Hotchkiss School, Lakeville, Connecticut; Professor Benson Ginsburg, University of Chicago; Professor Ray Owen, California Institute of Technology, Pasadena; and Professor Carl Swanson, The Johns Hopkins University, Baltimore, Maryland (Chairman).

The course is organized into 160 half-hour lecture-demonstrations. It was produced through the facilities of Station WTTW, an educational television station located in Chicago, Illinois. During 1961-62, the lessons were first telecast over 183 stations of the CBS television network and 12 educational stations. More than 200 colleges and universities offered the course for credit, and several school systems offered the course for in-service credit, while a larger number of secondary schools used the course for enrichment programs. An estimated 422,000 sets were tuned to the lessons daily. A large number of science teachers were part of the viewing audience.

**Sources of Further Information:**

Information on the availability of video tapes and kinescopes may be obtained from Dr. John W. Taylor at the address above, or from Dr. Thomas P. Robinson, Director, Laboratory for Educational Materials, 70 Fifth Avenue, New York 11, New York.

**55. LABORATORY EXPERIMENTS IN ELEMENTARY HUMAN PHYSIOLOGY.** CHARLOTTE HAYWOOD (*Editor-in-Chief*), Department of Physiology, Mount Holyoke College, South Hadley, Massachusetts. (Grantee: American Physiological Society, 9650 Wisconsin Avenue, Washington 14, D. C.) (1962)

*Laboratory Experiments in Elementary Human Physiology* presents a set of tested experiments applicable to an elementary course in human physiology at the level of college sophomores and freshmen whose background in biology may have come largely from secondary-school experience. A systematic coverage of the various aspects of the field has not been the objective, since many laboratory manuals which do this are available through publishers. The attempt has been to gather experiments which do not commonly duplicate, but rather supplement, those of the published manuals. Since it has not been easy to find suitable new experiments derived from research in human physiology, a number of experiments have been included which are modified versions of those used in more advanced courses, and experiments on other vertebrates than man are included insofar as they bring out important physiological principles. The limits imposed by a moderate budget are kept in mind as well as the level of the elementary student. To help teachers who wish classic physiological experiments, a few have been listed, with references to several available manuals. Certain practical aids are also included to help teachers who are setting up physiology laboratory work of this type for the first time.

**Sources of Further Information:**

Copies of these experiments may be obtained at $1.50 per set from Dr. Ray G. Daggs, Executive Secretary, American Physiological Society, at the address above.

**66. CINEPHOTOGRAPHIC TECHNIQUES IN MORPHOLOGY.** *(Secondary, College, Graduate)* R. D. FRANDSON, Department of Anatomy, Colorado State University, Fort Collins, Colorado. (1961–1962)

The specific objective of this project is to produce a sound-color motion picture for visualization of anatomical structures in depth, using the mammalian central nervous system for a pilot study. Stained serial sections of portions of the mammalian central nervous system subsequently will be individually photographed with a motion picture camera, with the hope that the succession of projected images will convey a three-dimensional concept of neural structures. Animation and gross dissections will also be used in the film. This film is planned for 16-mm sound-color between 10 and 20 minutes in length.

In connection with the project, a cinephonic camera and projector donated by Fairchild Instrument and Camera Corporation, will be used to produce experimental 8-mm magnetic sound films for educational purposes. The 8-mm magnetic format has an advantage over conventional 16-mm in lower cost of film and equipment with great versatility in adding and changing sound on the film. The plan is to produce several 8-mm magnetic sound films on laboratory techniques in biology and various phases of anatomy.

**Sources of Further Information.**

The 16-mm film will be distributed by the Audio-Visual Service of Colorado State University when available, probably late in 1963. The 8-mm films will be available from the project director on a loan basis.

**67. DEVELOPMENTAL ANATOMY FILMS.** Clarence M. FLATEN, Audio-Visual Center, Indiana University, Bloomington, Indiana. (1961– )

This project involves the production of instructional films on the development of the chick embryo. Five 16-mm films are to be produced within a three-year period, including the following:

1. *Cardio-Vascular System—The Heart*, sound, color or black-and-white, 20 minutes (to be released in 1963). Heart development in the early chick embryo, showing sites of heart-forming cells in the blastoderm and primitive streak stages, development and fusion of paired endothelial tubes, development of the muscular layer (epimyocardium), gut closure, and fusion, torsion and dilation in forming the heart; progressive fusion of paired primordia and its effect on heart page.

2. *Cardio-Vascular System—Circulation*, sound, color or black-and-white, 13 minutes. (Anticipated release date, December 1963.)

3. *Extra-Embryonic Membranes*, sound, color or black-and-white, 10 minutes. (Anticipated release date, January-February 1964.)

**Sources of Further Information.**

For further information, write to (1) Dr. Theodore W. Tyner, Chairman, Department of Zoology, Indiana University, Bloomington, Indiana, or (2) Dean L. C. Larson, Director, Audio Visual Center, Indiana University, Bloomington, Indiana.

**68. PLANT SCIENCE FILMS.** *(Secondary, College)* CHARLES E. BRADSHAW, Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa. (1961–1963)

*The purpose of this project is to prepare a* series of 3 to 10-minute 16-mm sound, color motion pictures in the plant sciences, designed to improve the coverage and effectiveness of college courses in plant science and high school and college courses in biology. The project is under the general direction of a steering committee of 11 botanists from colleges and universities throughout the country, under the chairmanship of Dr. Theodore F. Andrews, Department of Biology, Kansas State Teachers College, Emporia. Production of each block of films will be overseen by a committee consisting of outstanding botanists in the appropriate field. Film production will be carried out largely by the film production unit at Iowa State University. Tentative film titles include the following:

Group I. Structure and Life Cycles

1. Algal Syngamy
2. Relative Sexuality in Mucorales
3. Fertilization and Development of Sporophytes in a Bryophyte (with ecological emphasis)
4. Zoospore Formation and Dispersal in Representative Algae and Fungi
5. Significance of Pollen Tube Growth

Group II. Metabolism and Genetics

1. $CO_2$ Fixation
2. Hill Reaction
3. Mineral Nutrition
4. Genetic Ratios

Group III. Plant Processes

1. Auxins and Cell Elongation
2. Photoperiodism
3. Primary Growth

It is expected that the first films will be available for rental and purchase during 1963.

**Sources of Further Information**

Information about the films is available from the project director.

**58. MOTION PICTURE FILM ON PREDATOR-PREY RELATIONSHIPS.** FRANK A. PITELKA, Museum of Vertebrate Zoology, University of California, Berkeley 4, California. (1962)

The purpose of this project is to contribute to improvement of teaching of ecological relationships in college courses in biological sciences by preparing a soundcolor 16-mm motion picture film, 15-25 minutes in length, illustrating predator-prey relationships in biotic communities, as exemplified by certain bird and mammal populations in the Antarctic and Arctic. The basic footage from which the film will be developed was previously obtained as a part of research carried out at the poles by the director and his associate, Dr. William J. Maher, San Francisco State College. Production and distribution facilities will be provided by University Extension, University of California.

**Sources of Further Information**

Further information is available from the project director.

**See also**

- 17. FILMS ON THE NATURE OF VIRUSES
- 18. THREE EDUCATIONAL FILMS ON MYCOBACTERIA
- 19. "LIVING BIOLOGY" FILM SERIES

## D. Chemistry

**60. SUPPLEMENTARY TEACHING AIDS FOR INTRODUCTORY CHEMISTRY.** DONALD H. ANDREWS, Department of Chemistry, The Johns Hopkins University, Baltimore 18, Maryland. (1958-1961)

In September 1958 a new introductory chemistry course was initiated at The Johns Hopkins University with both lectures and laboratory set at a level more advanced than is customary in colleges and universities in the United States. The lecture study of chemistry is based essentially on thermodynamics and elementary quantum mechanics. To bring the level of the laboratory up to this advanced approach, it was necessary to include a number of new experiments. Under the grant, experiments were developed at an advanced level, including the construction of a cloud chamber for the study of radioactivity; measurements with vacuum line to determine gas behavior, vapor pressures, molecular weights, rates of reaction, the effect of catalysts, and the like. A simple ice calorimeter was devised for the measurement of heats of reaction, heats of fusion and of solution. The experiments have been tried out during four years of operation of the course and have been highly successful.

As another teaching aid, several motion picture films were made showing moving models of atomic and molecular structure and of chemical reactions. These have been a significant supplement to the course and have been exhibited at a number of other educational institutions. The methods of filming were discussed at a meeting of the American Chemical Society and will be described in a forthcoming article in the *Journal of Chemical Education*.

In addition, several new teaching approaches to thermodynamics and quantum mechanics for beginning students have been worked out and will be presented in forthcoming publications.

**Sources of Further Information**

R. J. Kirkes, M. K. Dorfman, and D. H. Andrews, "General Chemistry at The Johns Hopkins University," *Journal of Chemical Education* 35, 16 (1962). The experiments are described in detail in four other articles in the January and February 1962 issues of this journal.

**61. CONFERENCE ON UNDERGRADUATE TRAINING OF CHEMISTRY MAJORS.** R. E. WILLFORD, Department of Chemistry, Bucknell University, Lewisburg, Pennsylvania, and LESLIE R. CLARK, Department of Chemistry, Brown University, Providence 12, Rhode Island. (1960)

The accelerating growth of chemical knowledge and the improvement (both acknowledged and anticipated) of secondary school chemistry courses have made imperative a re-examination of the traditional program for the training of chemistry majors. The Division of Chemical Education of the American Chemical Society requested Bucknell University to hold a conference during the summer of 1960 to consider the total

undergraduate chemistry curriculum. Forty-five college and university faculty members of diverse interests from institutions of diverse purposes participated. The objectives of the conference were the promotion of a fruitful exchange of ideas among persons interested and involved in experimental curricula of various sorts, and the stimulation of interest in the modernization of the undergraduate programs at colleges throughout the country.

**Sources of Further Information:**

*Report of the Bucknell Conference on the Undergraduate Training of Chemistry Majors*, available from Dr. Willeford.

Bennett B. Willeford and Leallyn B. Clapp, "Undergraduate Training of Chemistry Majors: A Report of the Bucknell Conference," *Journal of Chemical Education* 38, 251 (1961).

**62. CONFERENCE ON CHEMISTRY FOR NON-SCIENCE MAJORS.** William B. Cook, Department of Chemistry, Montana State College, Bozeman, Montana, and A. B. Garrett, Department of Chemistry, The Ohio State University, Columbus 10, Ohio. (1961)

This project was a one-week conference of twenty-eight carefully selected college professors of chemistry. The principal purpose was to examine critically, on an exploratory basis, the appropriate course content and methods of teaching in chemistry courses for non-science majors and to make recommendations as to how such courses can be made more valuable to such students. Six distinguished scholars from disciplines other than chemistry were invited as consultants. They presented viewpoints and philosophies calculated to stress the inter-disciplinary nature and fluid-inquiry aspects of science. Specific recommendations and guidelines for the course are made in the report of the conference as are the unabridged texts of informal talks by consultants.

**Sources of Further Information:**

The 95-page conference report *Chemistry for Non-Science Majors* is available in limited quantity from the directors. A summary report of this conference, together with that from the related conference, "The Undergraduate Training of Chemistry Majors," was published in the *Journal of Chemical Education* 38, 251 (1961). This reprint is obtainable from the directors or Dr. W. T. Lippincott, Department of Chemistry, The Ohio State University.

**63. EXPERIMENTAL LABORATORY COURSE IN ORGANIC CHEMISTRY.** Melvin S. Newman and William White, Department of Chemistry, Ohio State University, Columbus 10, Ohio. (1960–1961)

The object of the year's work was to try out some ideas for the improvement of laboratory course work for chemistry majors seriously interested in chemistry as a career. The main objective of this course (which was the *first* organic laboratory course each student had) was to prepare students for research. Although the subject matter was organic chemistry, the directors believe that the philosophy of the work can be applied to research in any field. Students were supplied with the same type of equipment that is being used by students working for the Ph.D. degree; namely, a variety of glassware of research design, electric stirrers, magnetic stirrers, hot plates, heating mantles with temperature controls, vacuum pumps, etc. (estimated cost $200-$300 per student). Each student had work space of his own in the laboratory so that he did not have to put his material away between class periods. At the beginning of the course time was spent in learning some fundamental techniques, such as crystallization, distillation, extraction, chromatography, determination of melting points, elemental analysis (qualitative). Preparations were then assigned as problems rather than procedures to follow exactly. Students were sent to the library to look up ways in which certain reactions had been done and had to make their own decisions as to what to do. At the start, reliance on discussions with the assistant or the professors in charge was great. As the year progressed the students became more self-reliant. Features stressed included (1) repetition and refinement of experiments, (2) comparison of efficiency of alternative syntheses, (3) techniques in multi-step synthesis, and (4) report writing.

**Sources of Further Information:**

A final report is available from the project directors.

**64. PLANS FOR GENERAL COLLEGE CHEMISTRY.** (Secondary, College) Andrew Patterson, Jr., Department of Chemistry, and David G. Anderson,

Department of Educational Motion Pictures, Yale University, New Haven, Connecticut. (1960-1963)

Intended for general college and advanced high school chemistry courses, these 16-mm sound, color films are designed to leave the paramount role to the teacher. Most of the films are very short and can be used without sound track. To allow the teacher a choice of topics, each film deals with only a single demonstration or concept. To limit previewing time, teachers may obtain preview sheets which provide pictorial summaries of key scenes and accompanying narrations. Although all short films have sound tracks, teachers are urged to provide their own narration, based on the preview sheets or otherwise. Films now available or in production include:

*Laboratory Burners*, 9 min.
*Handling Chemicals—Solids*, 5 min.
*Handling Chemicals—Liquids*, 4 min.
*Handling Chemicals—Gases*, 3 min.
*Using Filters*, 2 min.
*Quantitative Transfer*, 17 min.
*Air-damped Analytical Balance*, 6 min.
*Single-pan Analytical Balance with Built-in Weights*, 6 min.
*Ion Removal by Metathesis*, 4 min.
*Using a Pipette*, 4 min.
*Metals and Non-Metals* (Introduction to Periodic Table), 9 min.
*Sulfur*, 9 min.
*The Bomb Calorimeter*, 9 min.
*Demonstrations for Solubility Product Calculations*, 7 min.
*Static Electricity—Induction*, 9 min.
*Proton Motions in Ice*, 5 min.
*Melting Points as a Function of Position in the Periodic Table*, 3 min.
*Melting Points*, 12 min. (in production)
*Electronegativity*, 5 min. (in production)
*Burette and Titration*, 8 min. (in production)
*Preparation of Oxygen—7 Demonstrations*, 10 min. (in production)
*Primer of Physical and Chemical Changes*, 9 min. (in production)

**Sources of Further Information:**

Rental and sale prices will be announced later. Preview requests should be directed to Andrew Patterson, Room 242, Sterling Chemistry Laboratory, Yale University, New Haven, Connecticut.

**65. ANALYTICAL CHEMISTRY AS A SECOND-LEVEL COLLEGE CHEMISTRY COURSE.** Beatrice E. Gushee, Department of Chemistry, Hollins College, Hollins College, Virginia. (1961–1962)

"Principles of Chemistry" is taught as an intermediate level physico-inorganic course with the prerequisite of a freshman chemistry course. It consists of two 4-semester hour courses with two hours of lecture and six hours of laboratory throughout the year. The laboratory emphasis is on analytical chemistry, both qualitative and quantitative, but the attempt is made to see that the experiments devised are illustrative of and emerge from classroom discussion of such principles as chemical equilibrium, the relationship of atomic and molecular structure to chemical interaction. The chief aim of this approach is to teach chemistry rather than analytical techniques while the laboratory work shows the students that progress cannot be made in chemistry without an understanding of stoichiometry furthered by the use of analytical techniques.

**Sources of Further Information:**

A report on the course developed is available from the project director.

**66. MODERN UNDERGRADUATE ANALYTICAL CHEMISTRY COURSES.** H. A. Laitinen, Department of Chemistry and Chemical Engineering, University of Illinois, Urbana, Illinois. (1961–1964)

New curricula for chemistry and chemical engineering majors are being adopted at the University of Illinois. Following a two-semester general chemistry course including some accurate quantitative technique (but not analysis), the students are to take a year of organic chemistry, overlapping by a semester with a year of physical chemistry. For the first time in the fall of 1962, they are to take a new analytical chemistry course (five hours) which follows two semesters of organic chemistry and one semester of physical chemistry. A second analytical chemistry course (three hours) is to be an elective.

This project involves development of the two new analytical chemistry courses, particularly with respect to design of new laboratory experiments. The first course is designed to stress the role of analytical chemistry, both chemical and instrumental, in research. About half the labora-

tory time (one long afternoon per week) is to be devoted to learning the fundamentals of chemical and instrumental methods. The other half is to be devoted to a study of chemical problems by analytical methods. It is this approach which is the object of the project.

Examples of the types of problems being investigated for development into student experiments are: (1) Study of coprecipitation of alkali metals with magnesium by flame photometric analysis of $MgNH_4PO_4$; (2) gas chromatographic separation of *cis* and *trans* olefins followed by determination of rate of isomerization of each, again using gas chromatography; (3) evaluation of an ion-exchange column, prediction and verification of degree of separation of metal ions; (4) assignment of sources of error by statistical inference and analysis of variance.

**Sources of Further Information:**

It is expected that successful experiments will be described by publications in suitable media such as the *Journal of Chemical Education*.

**67. ADVISORY COUNCIL ON COLLEGE CHEMISTRY** CHARLES C. PRICE *(Chairman)*, Department of Chemistry, University of Pennsylvania, Philadelphia 4, Pennsylvania; PETER E. YANKWICH *(Vice Chairman)*, Department of Chemistry, University of Illinois, Urbana, Illinois. (1962– )

The objective of this project is a profession-wide effort to stimulate and provide coordination among a number of independent efforts to improve undergraduate instruction in chemistry and to facilitate communication on the importance of good teaching and good teaching ideas in this field. Following a conference on college chemistry held in Washington in the fall of 1961, involving some 25 chemists from a number of institutions, Professors Charles C. Price (chairman), Arthur C. Cope, L. Carroll King, and Peter E. Yankwich were asked by their colleagues to serve as the organizing committee for a group to carry out the objective set forth above. The Council is currently establishing study panels concerned with (1) general chemistry, (2) curricula and advanced courses, (3) teaching aids, (4) teacher improvement, and (5) chemistry for non-technical students.

**Sources of Further Information:**

Further information will be available from the chairman.

See also:
33. VISUAL AIDS FOR TEACHING CHEMISTRY
30. LABORATORY COURSE IN INSTRUMENTATION

# E. Engineering

## General

**68. CONFERENCE ON ENGINEERING EDUCATION.** JOHN S. MCNOWN, School of Engineering and Architecture, University of Kansas, Lawrence, Kansas. (1961–1962)

Forty-two engineering educators and scientists convened at the University of Colorado, August 9-15, 1961, to define present and future needs of engineering education and to suggest ways of fulfilling them at the national level. The conference was planned by an *ad hoc* group of eleven engineering educators. The conference was originally organized to study five topics: engineering science; analysis, design, and experimentation; faculty development; educational environment; and the teaching-learning processes. Following panel work and discussions, the conference elected a "Commission on Engineering Education" (see 69 below) and charged this Commission with the responsibility for developing a plan to carry out a series of recommendations. The conference report sets forth a summary of the needs and aspirations for engineering education as viewed by the conferees; it is both the transactions of the conference and a charge to the Commission. The report is available from Dean McNown at the above address and was published as follows: "Engineering Conference Report," *Journal of Engineering Education* **52**, 624 (1962).

**69. COMMISSION ON ENGINEERING EDUCATION.** PAUL F. CHENEA *(Chairman)*, Purdue University, Lafayette, Indiana, and NEWMAN A. HALL *(Executive Director)*, Commission on Engineering Education, 1785 Massachusetts Avenue, N. W., Washington 6, D. C. (Grantee: Educational Services Incorporated, 164 Main Street, Watertown, Massachusetts.) (1962– )

The Commission on Engineering Education was established by a conference on engineering education at Boulder, Colorado, in August 1961

(see **68** above). The following charge was adopted by the conference:

Whereas, the general purpose of this conference has been to propose those measures which, when put into effect, will very *significantly advance* engineering education in the United States.

Whereas, the accomplishment of this urgently needed advancement is complex and difficult to achieve and will require extensive and sustained resources and efforts on a national scale.

And whereas, these resources and efforts must be directed toward the areas supportive of engineering education where important contributions may be made.

Be it resolved that the commission appointed by this conference will develop vigorously and in a balanced manner the following four areas:

1. Curricula, facilities and their systematic reorganization and development.

2. Preparation, production, and testing of instructional learning materials of high quality and proven effectiveness.

3. Effective programs for faculty development in:

   a. knowledge of the fields,
   b. research capability and involvement,
   c. the processes of instructing and learning relative to engineering students to serve as a basis for:
      (1) the improvement of instruction,
      (2) the assessment of the results of engineering education, and
      (3) increasing the efficiency of the educational process.

The central office activities being set up will endeavor to function as a point of coordination and as a stimulus in carrying out the above charge. Initial attention will be given to the primary objectives: (1) the enhancement of engineering faculties, and (2) the production and distribution of educational materials. Initially, the Commission will not be directly concerned with specific projects but will work in support of strong activities under way or proposed and will undertake coordinating studies to aid in the organization of appropriate new projects.

**Sources of Further Information:**

*Journal of Engineering Education* 52, 624 (1962).

A report on the Boulder Conference on Engineering Education and further information on the Commission's activities are available from the Executive Director.

**70. ANALOG AND ANALOG/DIGITAL COMPUTER TECHNIQUES FOR LABORATORY INSTRUCTION IN STATISTICS AND RANDOM PROCESSES.** *(College, Graduate School)* GRANINO A. KORN, Department of Electrical Engineering, University of Arizona, Tucson, Arizona. (1961–1962)

A laboratory course for teaching statistical methods as a background for theoretical courses is being developed. Equipment designed for use in the course includes (1) a simple noise generator to generate random variables with flexible analog computing elements and diode logic to operate on and combine such random variables and (2) simple amplitude-distribution analyzers and counters to measure estimates of mean values, probabilities, and other statistics without much paperwork; large or small samples can be analyzed in a matter of minutes.

**Sources of Further Information:**

J. Hartmann, G. Korn, and R. Maybach, "Low-cost Triangle-integration Multipliers for Analog Computers," *Annales de l'Association internationale pour le Calcul analogique*, No. 4 (October 1961).

Granino A. Korn, "Analog Computers in the Electrical Engineering Department", *Instruments & Control Systems*, 33, 1506 (1960).

A report describing the equipment, detailed circuit diagrams, and descriptions of laboratory experiments are available. Please address requests to Mr. Charles H. Peyton, Applied Research Laboratory, University of Arizona.

**71. INTERDISCIPLINARY ENGINEERING LABORATORY EXPERIMENTS.** *(College, Graduate School)* EDWARD F. OBERT and SAMUEL S. LEVIT, Department of Mechanical Engineering, University of Wisconsin, Madison 6, Wisconsin. (1961–1962)

A number of low-cost, portable, basic, multi-purpose experiments are being developed. The objective is to expose the student to several disciplines in *any one* experiment, rather than have an experiment, say, in heat power and another experiment in mechanical design. The disciplines include thermodynamics, heat transfer, stress analysis, statistics, and computers.

Specific experiments are also being designed to take advantage of special skills or special interests of the designer. At present, two analog

experiments in heat transfer have been designed, along with other experiments in fluid friction, combustion, and transient flow.

**Sources of Further Information:**

A report of prior work done at Wisconsin is contained in *Engineering Experiment Station Report No. 16*, obtainable from Dean Robert Marshall, University of Wisconsin, 1513 University Avenue, Madison 6, Wisconsin, for $5. The work now in progress will be published in 1963 as *Supplementary Report No. 16A* and will be available for a small charge.

**72. ENGINEERING GRAPHICS COURSE CONTENT DEVELOPMENT STUDY.** PAUL M. REINHARD, Department of Engineering Graphics, University of Detroit, Detroit 21, Michigan. (1961–1963)

The Engineering Graphics Study will gather and develop scientifically oriented subject matter which will be closely correlated with related undergraduate disciplines as an integral part of the total engineering curriculum, with emphasis on exploring the following four broad areas of graphics: (1) automatic processing of graphical information, including analog simulation; (2) creative engineering design; (3) applications of graphics to graduate and research studies; (4) graphical analysis and computations. The study is being carried out under the general direction of an advisory committee of outstanding engineers in various fields drawn from universities and industry. It is led by a core committee of educators in engineering graphics, with a central headquarters at the University of Detroit and regional offices at Princeton University and the University of California at Berkeley. Highly qualified scientists, engineers in colleges and industry, and other appropriate individuals and organizations will be asked to participate in developing and reviewing materials.

**Sources of Further Information:**

Interim reports and an evaluation of the project will be made available to all engineering and pre-engineering schools. The final publication will contain sufficient information to enrich and supplement current teaching of engineering graphics. This material will be so prepared that it may be drawn upon to meet the needs of individual institutions as required.

Periodic and final reports will be available from the project director. An article will appear in *The Journal of Engineering Graphics*, and progress reports will be published in *The Journal of Engineering Education*.

**73. DYNAMICS COURSE USING PERSONAL ANALOG COMPUTERS.** JAMES B. RESWICK, Engineering Design Center, Case Institute of Technology, Cleveland 6, Ohio, and MYRON TRIBUS, Thayer School of Engineering, Dartmouth College, Hanover, New Hampshire. (1962–1963)

A major goal of engineering education is to bring to the young engineer an understanding of dynamic systems. Modern technology requires him to design and predict the performance of electrical, mechanical, gas, and fluid systems. All engineering curricula contain courses in which students study the formulation and solution of differential equations which characterize such systems. While the mathematical expressions are quite manageable, it is difficult to permit the student to observe and explore the behavior of a dynamic system in a way that will help him to bridge the gap between the mathematical model and the behavior of the system itself. The analog computer can allow a student to experience the performance of a system in a way which gives him true insight into its behavior.

In order to improve courses which are concerned with teaching dynamic systems, a versatile solid-state battery powered analog computer system has been developed for use at the undergraduate level in engineering schools. Computer units performing the functions of addition, integration, and multiplication by a constant have been designed to be produced at a low cost so that each student in a class may be loaned a set of units sufficient to handle systems described by second order differential equations and suitable for use at any time or place (e.g., dormitory room, under a tree, etc.). A meter unit provides battery power and control signals. When simulating a system, a computer can be set to "solve" a problem continuously or in steps of a second or less. A "hold" state permits students to record data at the end of each second (or one quarter of a second) of operation. The user of the personal analog computer units need understand only differential equations and the functional block diagram.

**Sources of Further Information:**

Pastoria Electronics, Inc., 285 Columbus Avenue, Boston 16, Massachusetts, is developing 600 units for initial trial and evaluation at Case Institute and Thayer School (Dartmouth). An

part of the development they will engineer the computer units for minimum production costs, and details of design will be available to other manufacturers in producing the units.

**74. INTERDISCIPLINARY ENGINEERING LABORATORY TO TEACH EXPERIMENTATION.** *(College, Graduate School)* HILBERT SCHENCK, JR., Department of Mechanical Engineering, Clarkson College of Technology, Potsdam, New York. (1962–1963)

A series of laboratory exercises will be designed with the following features: (1) They will be suitable for laboratory groups made up of engineering students from the various specialty fields (i.e., civil, mechanical, and electrical engineering), and in some cases will enable each student to work from the special viewpoint of his specialty; (2) they will stress principles of experimentation rather than mechanical, theoretical, or "hardware" details; (3) some of the experiments will permit the rapid compilation of data samples large enough to enable the student to utilize statistical planning and analysis. Among the experiments contemplated are accelerated life tests of simple items following a Latin or Graeco-Latin square test plan; project-type tests involving feasibility tests of solar-powered generators and air-supported platforms in which the laboratory group projects its test data to decide on the practicality of a suggested prototype use or installation; analog studies of heat flow, fluid flow, or electrical field problems in which empirical curves must be fitted to data not previously found by other laboratory groups. In addition to these and other new experiments, it is anticipated that commonly engineering tests will be modified to fit the interdisciplinary and experimentation requirements. While a complete, one-semester laboratory course is envisaged as the end product, many of the tests will be usable and desirable in the standard laboratories as now taught, particularly those dealing with statistical planning and analysis, which are now almost absent from the laboratories in engineering colleges. The final results will be made available in a book-length report containing diagrams, photographs, sample instruction sheets, and analyzed data from the equipment.

Sources of Further Information:

Hilbert Schenck, Jr., *Theories of Engineering Experimentation*, McGraw-Hill Book Company, New York, New York (1961).

Further information will be available from the project director.

**75. ENGINEERING CURRICULUM DEVELOPMENT AND EVALUATION.** EUGENE HOTCHKISS, Harvey Mudd College, Claremont, California. (1962–1963)

The program is intended to seek the optimum undergraduate foundation for students going on to graduate study in engineering. The initial planning and the subsequent curriculum development of the College were much influenced by the "Report on the Evaluation of Engineering Education" published by the American Society for Engineering Education in 1955. A curriculum study was made possible in the summer of 1958 by a grant from the Fund for the Advancement of Education. Specific features of the curriculum include: substantial allocation of time (one-third) to the humanities and social sciences; the integration of the subject matter in mathematics, chemistry, physics, and engineering; the unspecialized engineering curriculum; and the continuing emphasis on design. Problems related to the development of the curriculum include determining the performance of students as engineers and scientists in competition with graduates of more conventional curricula, the development of an engineering curriculum fostering interest and competence in design, and the development of interest in engineering among freshmen and sophomores. The specific purpose of the program will be to improve laboratory work in physics, incorporate computer techniques into all laboratory programs, concentrate on the development of an improved and carefully articulated first-year program and further strengthen the engineering design program.

Sources of Further Information:

Results of work done under this program will be submitted to appropriate journals. See also "Engineering Problems at Harvey Mudd College," by W. E. Wilson, presented to the American Society for Engineering Education, U. S. Air Force Academy, Colorado, June 1962 (available from director).

See also:

[illegible]

## Aeronautical Engineering

**76. SENIOR LABORATORY IN AERONAUTICAL ENGINEERING.** E. J. H. [illegible], School of Aeronautical Engineering, Purdue University, Lafayette, Indiana. (Present address: School of Aeronautical Engineering, University of Washington, Seattle, Washington.) (1959–1960)

This grant financed, in part, the development of a senior laboratory, used in a required course in the seventh semester of an eight-semester program leading to the degree of Bachelor of Science in Aeronautical Engineering. The laboratory consists of fifteen experiments, involving simple apparatus but challenging to the experimenter from the point of view of the physical phenomena being observed. Simplicity of construction allows ready modification of experiments or easy addition of new ones at low cost as curricular emphasis changes. The course is designed to prepare the student to conduct an independent experimental investigation. The laboratory installations developed for this course include facilities for performing the following experiments: (1) supersonic wind tunnel measurements; (2) low speed velocity and pressure measurements; (3) shock tube flow measurements; (4) low pressure measurements; (5) hot wire steady flow measurements; (6) thermocouple calibration; (7) platinum resistance thermometer; (8) total temperature probe calibration; (9) flame temperature measurements; (10) DeLaval nozzle experiment; (11) photoelasticity; (12) strain measurements; (13) deflection measurement; (14) measurement of transient phenomena; (15) beam vibrations.

**Sources of Further Information**

Further information is contained in R. J. H. Bollard, G. M. Palmer, E. C. Brouillette, and W. W. Hill, *A Laboratory for Senior Students of Engineering*, Report No. MISC-60-2, School of Aeronautical Engineering, Purdue University, Lafayette, Indiana (June 1960).

## Ceramic Engineering

**77. STUDY OF CERAMIC ENGINEERING EDUCATION.** Joseph A. Pask, Department of Mineral Technology, University of California, Berkeley 4, California. (Grantee: American Society for Engineering Education and Ceramic Educational Council of American Ceramic Society.) (1962–1963.)

Ceramic engineering has traditionally been concerned with the production of non-metallic inorganic products with essentially non-critical specifications, including glass products, refractories, porcelain, pottery, structural clay products, cement materials, and abrasives. Recent developments and critical material needs in space exploration, electronics, and nuclear energy have created new and exacting demands on both the old and new ceramic-type materials. As a result, greater emphasis has been placed on contributions of solid state science, crystal chemistry, surface chemistry, thermodynamics, etc. Ceramic engineering curricula must take full cognizance of this situation and determine the best way of incorporating the new developments. The purpose of the study is to outline curricula that reflect these trends and developments.

**Sources of Further Information**

The final report, *Objective Criteria of Ceramic Engineering Education*, will be available from Mr. W. Leighton Collins, Executive Secretary, American Society for Engineering Education, University of Illinois, Urbana, Illinois, by the beginning of 1963.

## Chemical Engineering

**78. OBJECTIVES FOR CHEMICAL ENGINEERING.** (College, Graduate School) D. L. Katz, Department of Chemical Engineering, University of Michigan, Ann Arbor, Michigan; F. J. van Antwerpen, Secretary, American Institute of Chemical Engineers, 345 East 47th Street, New York 17, New York. (Grantee: American Institute of Chemical Engineers.) (1958–1960.)

The membership of the American Institute of Chemical Engineers through its Committee on the Dynamic Objectives of Chemical Engineering explored the changes in chemical engineering that would be required by the demands of the future. It concluded that a more science-oriented undergraduate curriculum with emphasis on chemistry will have to replace the classical applied engineering courses. The involvement of chemical engineering in areas such as space vehicles, nuclear energy, process control, environmental extremes, biological applications, etc., will require an intensive program in the fundamentals of engineering science to prepare the chemical engineer. Nor can he consider himself fully prepared, the committee pointed out, when he has completed four years of college. Industry, the professional societies, and the colleges must make available courses that will enable him to keep abreast of new developments. A whole new concept of post-college education must be developed. Formal graduate training, too, must emphasize the new. Imaginative and creative research on a wide range of problems should be encouraged. Illustrative sample curricula and descriptions of courses are

included in the report, as well as recommendations for interesting able engineers in teaching. Implicit in the entire report is the need to attract in sufficient numbers the well-prepared, superior student to the engineering curriculum.

**Sources of further information:**

The report of the committee *Dynamic Objectives for Chemical Engineering* is available from the American Institute of Chemical Engineers.

## Civil Engineering

**78 UNDERGRADUATE CURRICULA IN CIVIL ENGINEERING.** FELIX A. WILLIAM, Department of Civil Engineering, Cooper Union, Cooper Square, New York 3, New York. (Grantee: The Cooper Union; co-sponsors: American Society of Civil Engineers and American Society for Engineering Education.) (1958–1962.)

Recommendations on civil engineering curricula were evolved by a group of twenty-nine civil engineering educators and practitioners which met in three separate planning sessions. The recommendations were reviewed by 250 participants in a three-day conference held at the University of Michigan. The study recommended that: (1) the undergraduate civil engineering curriculum should extend over a five-year period; (2) the first three years should comprise a "common" or interchangeable core of subject matter for all engineering students; (3) the fourth year should provide for both terminal and transition students; (4) a degree in civil engineering should be given only at the end of the fifth year; and (5) a general bachelor of science degree may be given at the end of the fourth year. The study also recommended two separate "paths" for graduate work, one leading toward the professional degree of Doctor of Engineering and the other toward the research degree of Doctor of Philosophy.

**Sources of further information:**

Copies of the study report and further information regarding the general acceptance of the report by civil engineering educators may be obtained from the American Society of Civil Engineers, United Nations Plaza, New York, New York.

**See also**
78 CONFERENCE ON THE GRADUATE EDUCATION OF CIVIL ENGINEERS

## Electrical Engineering

**65 CURRICULUM WORKSHOP IN ELECTRICAL ENGINEERING.** CHARLES S. BROWN, Department of Electrical Engineering, Massachusetts Institute of Technology, Cambridge 39, Massachusetts. (1962.)

The Department of Electrical Engineering at the Massachusetts Institute of Technology organized and guided a Curriculum Workshop for professors of electrical engineering during the period of September 9-13, 1962. The main functions of the workshop were to present for review and appraisal in depth some examples of new curriculum syntheses with detailed discussion of typical subjects of instruction and supporting laboratory that had emerged over the previous three to four years, and to give engineering teachers sets of notes for classroom and laboratory use as an aid to guiding them in reorienting their own programs in accord with the best judgment of their faculty and administration. As one example of a revised approach to the teaching of the electrical sciences, the Department presented in detail its own curriculum. The material offered was admittedly far from ideal, even though it was the culmination of a five-year effort involving much new learning. It was aimed at providing a core of knowledge which, in the faculty's best judgment and commensurate with the four-year bachelor's degree program, was what each potential electrical engineer needs to know for the creative exploitation of modern science in the engineering world of his generation. The material was then being presented to MIT students in a sequence especially adapted to the particular student-staff environment and embraced such topics as circuit theory, field theory, electronic circuit devices and signals, electromechanical energy conversion, energy transmission and radiation, modern physics and molecular engineering. The interrelations and interactions of these topics with each other were stressed. Several participants outlined the current state of developments in their own institutions. The meeting pointed out the need for flexible interpretation of the meaning of the engineering sciences specifically mentioned in the AIEE Report on Engineering Education of September 1955.

Reports of the conference are no longer available.

**91. MATERIALS IN ELECTRICAL ENGINEERING EDUCATION.** SAMUEL SEELY, Department of Electrical Engineering, Case Institute of Technology, Cleveland 6, Ohio. (Address 1962–63: Engineering Section, National Science Foundation, Washington 25, D.C.) (1958)

This was a one-week workshop for representatives from almost all electrical engineering departments in the United States accredited by the Engineers Council for Professional Development, plus representatives from many of the important departments of electrical engineering in Canadian colleges. It was the second workshop developed by the Electrical Engineering Division of the American Society for Engineering Education (ASEE), and followed the workshop (described above) at the Massachusetts Institute of Technology by two years. The workshop was devoted to an exploration of the place and the content of course work in the broad field of materials in the educational experience of electrical engineering students. Part of the time was devoted to presentations by educators who have been addressing themselves to this broad problem at their home institutions. A number of experts in the various phases of materials presented talks showing the relation of properties to structure and discussing problem areas that remained to be studied. Opportunity was provided for discussion among the participants to relate the results of individual efforts and to explore jointly ideas for possible action. The formal presentations were distributed to the registrants. No conference notes were published.

**92. SYSTEMS ENGINEERING IN ELECTRICAL ENGINEERING EDUCATION.** JOHN G. TRAINER, The Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia 4, Pennsylvania (1961)

The Workshop on Systems Engineering in Electrical Engineering Education considered systems engineering as a horizontal field cutting across vertically organized fields of engineering, and studied specifically the impact of systems engineering on electrical engineering education. The five-day workshop began August 28, 1961, and was attended by 125 representatives from accredited electrical engineering departments. Speakers presented outlines of both broad general experiences in the area of the topic and specific discussion of so-called "techniques", including value theory and measures of effectiveness, queuing theory, mathematical programing, models and modeling, simulation, operational gaming, etc. There was also a brief discussion of the potential effects of development of the systems engineering concept on courses in engineering economy given to electrical engineering students. In addition, a business gaming problem was chosen to illustrate many aspects of systems work. Although this was not systems engineering in a strict sense, it was used because of the availability of computer programing, availability of competent advisors, and recognition of the many parallels which operation of a business system afforded.

**Sources of Further Information:**

A summary of the proceedings will be published in the *Transactions of the Professional Group on Education of the Institute of Radio Engineers*, during 1962 or 1963.

**93. SEMICONDUCTOR ELECTRONICS EDUCATION COMMITTEE.** CAMPBELL L. SEARLE, Department of Electrical Engineering, Massachusetts Institute of Technology, Cambridge 39, Massachusetts. (Grantee: Educational Services Incorporated, 164 Main Street, Watertown 72, Massachusetts) (1961– )

The Semiconductor Electronics Education Committee comprises university and industrial people brought together through the facilities of MIT to improve the teaching of semiconductor physics, devices, and circuit applications at the undergraduate college level. Taking the transistor as the major representative in the field, and probably limiting consideration to it for the central part of the effort, the committee is preparing a program of teaching which not only explains but also demonstrates introductory semiconductor physics, principles of semiconductor devices, and important features of electronic circuit design and construction employing semiconductor devices. The course will emphasize especially the relationship between the physical properties of semiconductor components and their circuit applications, with close attention given to the corresponding special advantages and limitations. The committee plans to prepare, in closely coordinated form, text material, laboratory experiments that can be performed in the dormitory, some more formal laboratory material, and approximately ten films.

**Sources of Further Information:**

Further information is available from Educa-

tional Services Incorporated, or the project director.

**84. CONFERENCE ON MOTION PICTURES FOR INSTRUCTION IN ELECTRICAL ENGINEERING.** WILLIAM L. EVERITT, College of Engineering, University of Illinois, Urbana, Illinois. (1962–1963)

The conference (September 24-25, 1962) was called for the following purposes:

1. To study pertinent instructional films and survey present sound-motion picture production facilities in order to establish major guidelines for the types of films to be made and the production facilities to be used.

2. To study the needs for sound-motion pictures in the various areas of electrical engineering instruction and to select the area for which the initial series of films demonstrating fundamental phenomena, concepts, and principles should be made.

3. To select a national committee which will attempt to obtain financing through suitable agencies, guide production, and promote the widespread use of demonstration films for the selected area of electrical engineering.

**Sources of Further Information:**

Further information is available from the project director.

**85. UNDERGRADUATE COURSE IN FIELD AND FLOW SYSTEMS.** ROBERT L. SCHRAG, Department of Electrical Engineering, University of Wichita, Wichita, Kansas. (1962–1963)

This project is the development of an interdepartmental course in field and transport phenomena, treating disciplines heretofore taught as the individual subjects of fluid dynamics, heat transfer, diffusion, and electromagnetics. It is a two-semester junior course (of four credit hours per semester), includes a laboratory, and is intended to provide a basic foundation for subsequent courses in each of several engineering departments. Particular emphasis is placed upon unification of treatment with regard to physical principles, solution techniques, and nature of results. Principles and techniques applicable only to a single discipline are not excluded. Students are assumed to have a background in ordinary differential equations, thermodynamics, and elementary mechanics. The additional mathematical tools of vector analysis and elementary tensors, complex functions, and partial differential equations are developed in the course.

This course is being developed as part of an engineering science core program which was adopted in 1959 at the University of Wichita. It has undergone partial development as result of core program planning and an initial course offering during academic year 1961-62. The major effort during the grant period will be devoted to further improvement of course organization, compilation of extensive notes, and development of special laboratory apparatus.

**Sources of Further Information:**

For supplementary information on this course and its role in an engineering core program, see: A. T. Murphy, "A Program in Engineering Science for All Engineering Students", *Electrical Engineering* 78, 1006 (1959). Inquiries may be directed either to the project director or to Mr. Kenneth Razak, Dean of the School of Engineering, University of Wichita, Wichita, Kansas.

## Materials Engineering

**86. TEACHING AIDS IN SCIENCE OF ENGINEERING MATERIALS.** ROBERT T. HOWARD, Department of Mechanics and Materials, University of Wichita, Wichita, Kansas. (1961–1962)

"Science of Engineering Materials" is a new course within the framework of a 49-hour core curriculum in engineering sciences taken by all engineering majors at Wichita University. The course serves majors in mechanical, electrical, aeronautical, and industrial engineering degree programs. It is taught at the junior level with a co-requisite course, "Modern Physics," offered by the physics department. The course is being developed within a department of mechanics and materials. The university has equipped the laboratory with a metallograph, micro-hardness tester, x-ray diffraction apparatus, and precision electrical instruments for potential and dielectric measurement, in addition to its existing (conventional) materials testing machines: tensile, torsion, impact, fatigue, and hardness testers. Projects already completed under the grant include plastic models for demonstration of various elastic effects in the continuum; self-stacking models of body-centered cubic, face-centered cubic, and hexagonal close packed structures. Models under way are classic representations of metallic electrical conductivity. Still to be accomplished are overlay

module for use with an overhead projector. These latter are intended to convey quantum ideas of bonding in molecular structure.

Sources of Further Information

Further information can be obtained from the project director.

See also

59. STUDY OF COURSE ENGINEERING EDUCATION
61. MATERIALS IN ELECTRICAL ENGINEERING EDUCATION

## Fluid Mechanics

**57. MOTION PICTURES IN FLUID MECHANICS.** Lorenz G. Straub, University of Minnesota, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minnesota. (1960– )

*Fluid Mechanics—The Boundary Layer* is a 16-mm, sound-color picture running 30 minutes. It contains a series of experimental demonstrations intended to supplement the classroom work and textbook explanations. These demonstrations are for the instructor to perform before his class if time and facilities permit. The flow demonstrations are associated with the presentation of graphs and sketches to make a continuous orderly presentation. The subject matter of the picture falls into four main sequences as follows: (a) the boundary layer of a flat plate (12 minutes); (b) boundary layers and pipe flow (6 minutes); (c) separation of the boundary layer (7½ minutes); and (d) roughness in the boundary layer (4½ minutes). Several additional films on fluid mechanics are planned.

Sources of Further Information

The film is available for rent or sale for educational showings. Distribution is handled by the St. Anthony Falls Hydraulic Laboratory.

**58. FILMS ON THE MECHANICS OF FLUIDS.** Hunter Rouse, Iowa Institute of Hydraulic Research, State University of Iowa, Iowa City, Iowa. (1960– )

Six 28-minute sound films in color are being produced to cover the following material: (1) An introduction to the mechanics of fluids, stressing its great breadth of coverage, the necessarily close tie between theory and experiment, the role of the scale model in engineering analysis and design, and methods of flow measurement in laboratory and field. (2) The source and significance of the fundamental principles of continuity, momentum, and energy, and their application to typical problems in many professional fields. (3) Gravitational phenomena, including jets, oxygen, channel transitions, waves, surges, and effects of density stratification. (4) Effects of viscosity, examples of laminar flow, characteristics of fluid turbulence, and problems of surface resistance. (5) Form drag and lift, and their application to propulsion and fluid machinery. (6) Compressibility effects—water hammer, submarine signalling, gravity-wave and sound-wave analogies, and supersonic drag.

Sources of Further Information

Information concerning availability of the films may be obtained from Bureau of Audio-Visual Instruction, Extension Division, State University of Iowa, Iowa City, Iowa.

**59. DEMONSTRATION EXPERIMENTS FILMS IN FLUID MECHANICS.** Arthur H. Shapiro, Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge 39, Massachusetts. (Contact: Educational Services Incorporated, 164 Main Street, Watertown 72, Massachusetts, for the National Committee for Fluid Mechanics Films.) (1961– )

The project, which is under the general direction of the National Committee for Fluid Mechanics Films, is aimed at the production of about 25 films in the area of fluid mechanics. These films will be built around demonstration experiments, rather than around lectures. They are intended to help students grasp the physical phenomena which are the true objects of the theoretical presentations given in the classroom. The availability of such films will make possible a better educational experience in both the classroom and the laboratory. The films will be introductory in character, in the sense that they will deal with basic physical phenomena. Moreover, they will deal with fluid dynamics as a broad discipline ranging across all the fields of engineering and applied science. Because they deal mainly with physical experiments, the films will be useful for both undergraduate and graduate courses. Most of the films will be 16-mm, sound, black and white, and about 30 minutes in length. Two are now available: *The Fluid Dynamics of Drag* and *Vorticity*. Other films to be produced during the forthcoming year are tentatively titled *Surface Tension*, *Wave Propagation*, *Visualization Methods*, *One-Dimensional Gas Dynamics*,

*Kinematics, Potential Flow and Separation, and Lift.*

**Sources of Further Information**

Ascher H. Shapiro, *Shape and Flow: The Fluid Mechanics of Drag*, Anchor Books, Doubleday & Company, Inc., Garden City, New York (1961)

An article, "Motion Picture Films for the Engineering Sciences," by Ascher H. Shapiro is soon to be published in the *Journal of Engineering Education*.

Inquiries regarding the films and requests for the newsletter of the National Committee for Fluid Mechanics Films should be addressed to Educational Services Incorporated.

**[illegible]** *(College Graduate School)* Fluid Laboratory, Department of Mechanical Engineering, New York University, New York 53, New York. (1961–1962)

Information on significant and novel experiments in the areas of heat transfer and fluid mechanics is being collected on a nationwide basis, evaluated, and distributed. The final report will list educational objectives, underlying theory, construction details, suppliers (where appropriate), and procedures to allow interested schools to construct similar equipment for their own use. The topics covered will include student participation experiments, demonstrations, visual aids and student project experiments.

**Sources of Further Information**

The final report will be made available to all interested educators. In addition, it is expected that the work will be reviewed at either the 1962 meeting of the American Society for Engineering Education or the meeting of the American Society of Mechanical Engineers.

## Mechanical Engineering

**[illegible]** T. E. Jackson, Department of Mechanical Engineering, Lehigh University, Bethlehem, Pennsylvania. (1960–1962)

The purpose of the project is the improvement of undergraduate mechanical engineering laboratory courses and the development of "bench-type" equipment for use in the laboratory or for demonstration in the classroom. A bibliography of current publications applicable to the philosophy of the laboratory, as well as actual laboratory problems, has been prepared. A listing of suppliers of various pieces of equipment, components, and instrumentation especially suitable to this type of laboratory work is also available. Currently, shop drawings are being made of equipment, mainly in the field of vibrations, that has been constructed and tested in the student laboratory. The drawings will be released in the near future.

**Sources of Further Information**

Reports and information may be obtained from the project director.

**[illegible]** G. L. Gaskin, Department of Mechanical Engineering, North Carolina State College, Raleigh, North Carolina. (Present address: Department of Mechanical Engineering, University of Maine, Orono, Maine.) (1960–1962)

This project involves: (1) a study of the objectives of experimental mechanical engineering in the whole curriculum; (2) careful search of departments of mechanical engineering to discover unusually successful low-cost experiments which meet these objectives; (3) the design of new low-cost non-commercial experiments which appeal to the students' creativity and exemplify important principles developed in theory courses; (4) the preparation of drawings and specifications, and the fabrication of prototypes of these experiments; (5) the testing and perfection of experiments by the use of the prototypes under actual instructional conditions; (6) the preparation and distribution of a manual setting forth outlines of experiments, drawings of equipment, specifications of equipment to all interested departments of mechanical engineering in the United States.

**Sources of Further Information**

Further information is available from the project director.

**[illegible]** P. W. McFadden, School of Mechanical Engineering, Purdue University, Lafayette, Indiana. (1962–1963)

Prototype equipment is being developed to be used in a laboratory course offered in conjunction with a three-credit hour course in Heat and Mass Transfer for sixth-semester students.

Equipment and student participation experiments being developed are as follows: (1) an inexpensive supersonic blowdown wind tunnel system

$(V^1_2)^2$ x $(V_2)^2$ test section cross section) for heat, mass, and momentum transfer analogy; (2) an inexpensive optical system capable of separating the Debye and ruppel enough for student use for measurement of flame temperatures; (3) a simple single fluid heat exchanger with control system capable of controlling power input, inlet velocity, and inlet fluid temperature with time for steady state and transient analysis; and (4) a student instrumentation for steady state and transient diffusion analysis.

**Sources of Further Information**

Equipment and experiments will be described in a report to be put out by the School of Mechanical Engineering, Purdue University, probably in October 1963.

**AN UNDERGRADUATE MECHANICAL ENGINEERING MEASUREMENT LABORATORY.** Lafayette Center, School of Mechanical Engineering, Purdue University, Lafayette, Indiana. (1962)–(1963)

The objective of this project is to develop equipment for an engineering measurement laboratory for fifth-semester undergraduates who have previously studied physics, differential equations, and electric circuits. Experiments for which this equipment will be used will emphasize the dynamic measurements of displacement, velocity, acceleration, force, temperature, flow, and power. The equipment will make possible the following measurements: Acceleration of a rocket sled and associated rocket chamber pressure, pressure vs. time in a combustion bomb, force and displacement vs. time in a landing gear, vibration of small reed valves, and pressure transducer calibration with a small shock tube.

**Sources of Further Information**

Descriptions of the apparatus developed, suggested experiments, and typical results will be incorporated into a brochure which will be distributed to the deans of faculties of engineering colleges. Some additional copies will also be available on request.

The philosophy behind these proposed experiments and of the undergraduate Mechanical Engineering Laboratories at Purdue University is set forth in a report entitled *Laboratories for Mechanical Engineering* available from Dr. R. L. Grosh, Head, School of Mechanical Engineering, Purdue University, Lafayette, Indiana.

## Sanitary Engineering

**[illegible] CONFERENCE ON THE GRADUATE EDUCATION OF SANITARY ENGINEERS.** Ross Eliassen, Civil and Sanitary Engineering Department, Massachusetts Institute of Technology, Cambridge 39, Massachusetts. (Present address: Department of Civil Engineering, Stanford University, Stanford, California.) (1960)

This conference brought together a group of about 100 sanitary engineers and scientists from the fields of education, industry, consulting engineering, public health, and public works agencies for a three-day discussion and study of means for raising the educational standards of the sanitary engineering profession and at the same time meeting the diverse requirements of the potential employers of sanitary engineers. The conference was divided into three major committees: Water Resources Engineering, Air Resources Engineering, and Public Health Engineering. Plenary sessions were held on four occasions, first to set up the conference, then to discuss the preliminary reports and final reports, and finally to adopt resolutions and recommendations. Sanitary engineering curricula were developed with a core content common to all fields covering about one-half of the graduate program. Engineering areas to be covered in depth for each of the specialties were also spelled out, together with suggested electives.

As a result of this conference, engineering and public health schools teaching sanitary engineering can set up their curricula on a basis which will gain wide recognition. This is very important because there is no accreditation system for graduate programs in engineering. This conference was not an accreditation meeting in any sense of the word, but rather an attempt to codify the requirements for the graduate education of sanitary engineers among the various disciplines which must be involved in such education.

**Sources of Further Information**

*A Report of Study Conference on the Graduate Education of Sanitary Engineers* has been distributed by the American Sanitary Engineering Intersociety Board, Inc., one of the co-sponsors of the conference. Copies have been made available to schools of engineering and public health as well as to members of the American Academy of Sanitary Engineers. Extra copies of the report may be obtained by writing to Prof. Perry L. McCarty, Room 1-142, Massachusetts Institute of Technology, Cambridge 39, Massachusetts.

**Solid Mechanics**

NO. THEORETICAL AND APPLIED MECHANICS CURRICULA. *(College, Graduate School)* Martin Lessen, Graduate School, University of Colorado, Boulder, Colorado. (Present address: Structural Mechanics Branch, Office of Naval Research, Washington 25, D. C.) (1963)

This study group attempted to provide guides, detailed technical outlines, and abstracts of courses for improving college solid mechanics curricula in an engineering program. The latest thinking and developments in solid mechanics were incorporated into undergraduate and graduate courses which were aimed at developing an integrated curriculum in solid mechanics with increased emphasis on solid state physics, metallurgy, applied mathematics, and engineering sciences. On the first day of the week-long study session, four papers were presented containing abstracts and outlines of solid mechanics curricula. On the following days each of the four speakers acted as the chairman of a committee concerned with his primary area of interest in solid mechanics. During this period, the details of the various curricula were studied, and written discussions (which had been submitted in advance by the participants) were studied by the organizational committee. On the last day of the study, all four committees presented their final integrated results to all participants in the study session.

The final report was published as a book: H. Liebowitz and J. M. Allen, editors, *Curricula in Solid Mechanics*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey (1963).

# F. General

ST. ACTIVITIES OF THREE FILM COMMITTEES. *(Elementary, Secondary, and College)* Robert E. Carey, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, N. W., Washington 25, D. C. (1959-1962)

I. *Visual Education Committee*, American Geological Institute; Chairman: Dr. William R. Muehlberger, Department of Geology, University of Texas, Austin 12, Texas.

Standards for evaluation of educational films in the geological sciences have been developed by the Visual Education Committee. An annotated directory of geology films has been prepared under the guidance of the Committee by Dr. Wakefield Dort, Jr., University of Kansas. This directory, published in the spring of 1962, lists over 500 films which have been viewed and evaluated as to level of suitability, subject-matter content, and quality of production. The Directory can be obtained from the American Geological Institute, 2101 Constitution Avenue, N.W., Washington 25, D. C. The Committee is also planning several projects involving the preparation of educational films.

II. *Committee on Mathematical Films and Television*, National Academy of Sciences-National Research Council, Chairman: Dr. Carl Allendoerfer, Department of Mathematics, University of Washington, Seattle 5, Washington.

A. *Films and Television.* The Committee studied current curriculum revision projects in mathematics and viewed films and kinescopes made for these courses. It also screened mathematical films produced in the United States and several European countries for instruction at secondary school and college level. As a pilot project, the Committee has undertaken preparation of a Film Evaluation Form and of film reviews for publication in journals of professional and educational mathematical organizations. Reviews will include a brief summary of film content and technical data and evaluation of the films for scientific accuracy, method of subject presentation, and educational effectiveness. The Committee is also considering the production, in cooperation with other mathematical organizations, of special films and courses in mathematics.

B. *Teaching Machines.* The Committee's concern for improvement of course content was expressed in letters to producers of programmed courses in mathematics, which stated that

> The teaching of mathematics is undergoing many rapid changes, and it is important that new devices for learning present the best not only in psychological techniques but also in the content of the subject being taught.

III. *Interdisciplinary Programs* — Films and Television in Science Education.

Two valuable aspects of current curriculum revision programs seldom noted in reports of the individual disciplines are the increasing degree of cooperation among educators and subject-matter experts at all levels and the cross-disciplinary exchange of ideas and information. Thus, university scientists and mathematicians who have worked

on these programs are trying them in classes in elementary and secondary schools, and representatives of curriculum projects in biology, chemistry, earth sciences, engineering, mathematics, and physics have met together to discuss their objectives and methods. This interdisciplinary cooperation has been especially useful in planning the filmed sections of the curriculum programs. Industry, government, and the medical profession, for instance, have successfully used films in their training programs, and all of the sciences are making increasing use of motion picture film as an indispensable tool in basic research. Through interdisciplinary meetings, the experience and advice of these groups has been made available for the curriculum project films. Several meetings of scientists, educators, and scientific cinematographers led to the creation in April 1961 of the American Science Film Association to foster the use of motion pictures and allied communications media for scientific research and education. The Association has assisted in the selection of films of educational, research, or popular science nature for scientific meetings in this country and for international groups such as the Pacific Science Congress and the International Scientific Film Association. Future meetings are planned to bring together film specialists from the various curriculum projects and to keep them in touch with similar science education programs in other countries.

**49. TELEVISION COURSE ON SCIENCE FOR ELEMENTARY SCHOOL TEACHERS.** *(Elementary, Secondary)* CHARLES T. LOPTIN, Graduate School, and W. B. BAKER, Department of Biology, Emory University, Atlanta 22, Georgia. (1960-1962)

In order to help teachers make better use of a new series of science guides prepared for grades 1-10 in Georgia schools, a combined television and workshop program has been developed for in-service education. The program consists of 32 one-hour telecasts, arranged in 8 blocks of 4 programs each. Three programs in each block are viewed by teachers in their schools or at home; the fourth is seen at a workshop at which a university scientist can lead discussions, conduct demonstrations, and direct laboratory experiments. The course was presented in 1960-61 and in 1961-62; it is hoped that it can be repeated in coming years. The telecasts make use of a new series of 88 filmstrips designed for the science program in grades 1-8. (The filmstrips are available from Colonial Films Company, Atlanta, Georgia.)

Titles of the telecasts are as follows:

1. *The Georgia Science Curriculum Guides—Explanation and Use*
2. *Basic Concepts of Matter, Energy, and Change*
3. *Techniques of Problem Solving in Teaching of Science*
4. *Basic Concepts of Energy and Change*
5. *The Earth as Our Immediate Environment*
6. *How Energy Changes the Surface of the Earth*
7. *The Nature and Behavior of Water*
8. *Experiments to Determine Characteristic Properties of Air*
9. *Life, Origin, and Relation to Earth*
10. *Conservation of Living Organisms*
11. *Soils and Their Relation to Organisms*
12. *Man's Use and Control of His Environment*
13. *Basic Concepts of Chemical Reactions*
14. *Basic Concepts of the Universe and Solar System*
15. *Atomic Energy—Solar Radiations—Heat*
16. *A Study of Light—Nature of—Source of*
17. *A Study of Heat—Its Nature, Production and Transfer*
18. *Electricity — Properties — Production — Uses*
19. *Machines as Means of Utilizing Energy*
20. *Sound—Nature of—Sources of—Transfer of—Reception by Human Ear*
21. *Different Kinds of Living Organisms*
22. *Foods and Energy Relations in Organisms*
23. *Energy Relationships in Organisms*
24. *Reproduction in Organisms*
25. *Germination of Seeds and Development of Plants*
26. *Control of Plants and Animals by Man*
27. *Specific Experiments in Breeding Drosophila*
28. *Classification of Plants and Animals—Taxonomy*
29. *Record Left by Fossils*
30. *Conditions Producing Weather*
31. *Problems of Space Travel*
32. *Concepts of Science and Human Welfare*

**Sources of Further Information.**

Inquiries regarding any phase of the program should be addressed to Dr. Baker.

**60. CONFERENCE ON THE NATURE AND PURPOSE OF UNDERGRADUATE SCIENCE FOR THE NON-SCIENCE MAJOR.** Robert Brown, Michigan State University Oakland, Rochester, Michigan. (1961-1962)

The conference, held at Michigan State University Oakland during May 1962, addressed itself to the following question: Given the present state of scientific knowledge, what should we expect undergraduate non-science majors to learn about science and how should we best arrange things to see that they learn it? Approximately 20-25 outside participants were involved, together with 6-8 Michigan State University Oakland professors and four undergraduates from Michigan State University Oakland and other institutions. Among the central topics that received serious discussion were: (1) the history of science approach; (2) the philosophy of science approach; (3) the "integrated" science approach; (4) the "case study" approach; (5) the role of the science laboratory; (6) the mathematics component of a science requirement for non-science majors; (7) the place of the behavioral sciences in the so-called "science" requirement; (8) the appropriate curricular length of the science requirement.

Three major papers were read, each representing a response to the puzzling conference question by a physical scientist, a biological scientist, and a behavioral scientist. Each was followed by a brief critical response from two discussants assigned in advance, who had studied the paper prior to the conference. After open discussion of the papers and discussants' responses, four groups met independently throughout the second day of the conference, each in an effort to (1) clarify the central problem of the conference, (2) study alternative approaches to the problem suggested in the initial papers and discussions, (3) develop its own set of recommendations. During the third day the conference as a whole met to hear each discussion group leader deliver his report, and to join in a common effort to pool concrete recommendations.

**Sources of Further Information:**

A report summarizing the discussions and major recommendations of the conference will be published and made available upon request to other institutions by December 1962.

**61. [illegible]**
[illegible]

## G. Geology

**62. GEOLOGICAL EDUCATION ORIENTATION STUDY (GEO-STUDY).** William W. Hambleton (Director), Department of Geology, University of Kansas, Lawrence, Kansas. (Grantee: American Geological Institute, 2101 Constitution Avenue, N. W., Washington 25, D. C.) (1962-1964)

The Geological Education Orientation Study is a study of undergraduate education in the geological sciences. It will take approximately two years and will involve the participation of faculty members from both undergraduate and graduate-oriented departments in educational institutions large and small, public and private. The University of Kansas will provide institutional facilities and various advisory services to the American Geological Institute in the conduct of Geo-Study.

The objectives of Geo-Study are to consider and develop guidelines for improved undergraduate instruction in the geological sciences to meet the changing patterns of the science. Attention also will be given to the unique aspects of instruction in departments recognized for their achievements. The objectives and programing of Geo-Study are planned to be sufficiently flexible to permit the consideration of new ideas and patterns which emerge during the two-year study.

The program will be guided by a steering committee under the chairmanship of the project director. Task force teams will study curriculum and course content problems at the undergraduate level. The work of these task forces will be supplemented by selected teams of faculty members visiting departments of various sizes and orientation. The findings and guidelines resulting from Geo-Study will be discussed in open sessions at both regional and national meetings. It is anticipated that some ideas and concepts growing out of the study may require experimental development and testing. The need for continuing review of problems of geological education with changing conditions appears probable.

**Sources of Further Information:**

Further information on the Geological Education Orientation Study is available from the project director. For information on various publications relating to college-level education in the geological sciences, write the American Geological Institute.

# H. Mathematics

**102. EXPERIMENTAL FILMS IN MATHEMATICS.** (*Secondary, College*) Leon Henkin, School of Mathematics, Institute for Advanced Study, Princeton, New Jersey. (Grantee: Mathematical Association of America, University of Buffalo, Buffalo 14, New York.) (1958-1962)

This project has as its goal the preparation of three different types of 16-mm. motion pictures: (1) a freshman-sophomore level film, (2) a junior-senior level film, and (3) a popular colloquium-type lecture for undergraduate students. It is also planned to experiment with different techniques of production, such as films in color or black-and-white, animation, and kinescope films.

To carry out (1), a lecture by Professor Leon Henkin of the University of California, Berkeley, on *Mathematical Induction* was filmed in color-sound, 2 reels, for a total of 60 minutes.

For (2), Professor E. J. McShane of the University of Virginia lectured on *Theory of Limits* on a black-and-white, sound film, 4 reels, for a total of 72 minutes. This film used the technique of projecting all written material on the board instead of having it written by hand.

For (3), a motion picture is being produced of Professor A. S. Besicovitch of the University of Pennsylvania, lecturing on *The Kakeya Problem*.

The films can be borrowed at nominal cost or purchased. Film manuals have been published to accompany the films by Henkin and McShane. They contain an approximation of the words spoken in the film, appendices to amplify the treatment of the subject, and a number of problems. These books are being sold for $1 each.

**Sources of Further Information:**

For further information, write to Dr. Harry M. Gehman, Executive Director, Mathematical Association of America.

**103. EXPERIMENTAL MOTION PICTURES FOR ELEMENTARY SCHOOL MATHEMATICS TEACHERS.** David A. Page, University of Illinois Arithmetic Project, University of Illinois, Urbana, Illinois. (1960-1962)

This project undertook an experiment in the filming of classes of elementary school children while they are being instructed in mathematics. No films for general viewing resulted. It was determined that the technical problems in such work are soluble. The results predict that if several sequences of classes running for several weeks each are photographed, then a group of films that would be worth distributing generally to teachers could probably be produced. The filming was done in the motion picture studios of Educational Services Incorporated, at Watertown 72, Massachusetts. The film work was directed by Mr. Jack Churchill.

**104. FILMS FOR MATHEMATICS TEACHERS.** Paul C. Rosenbloom, Mathematics Section, Minnesota National Laboratory, Minnesota State Department of Education, St. Paul 1, Minnesota. (1960-1961)

About 200 half-hour films were produced. For each of grades 7-12, a series of demonstration classes is taught with the materials of the School Mathematics Study Group (SMSG). With each of these series there is also a set of 14 to 20 lectures for teachers on the mathematics background of the new courses at each grade level, 7 to 12. There is also a general introductory film on the various recent developments in the mathematics curriculum, and a series of 20 lectures and demonstrations on the psychology of elementary mathematical concepts, directed at elementary teachers. These films are accompanied by homework problems suitable for use with filmed or television courses for preservice or inservice education of teachers.

**Sources of Further Information:**

About 150 of the films are available for rental or purchase at this time, and it is expected that the remaining 60 will be available at some future time. Further information can be obtained from the Minnesota National Laboratory. Film sales and rentals are handled by the Audio-Visual Extension Service, University of Minnesota, Minneapolis 14, Minnesota.

**105. COMMITTEE ON THE UNDERGRADUATE PROGRAM IN MATHEMATICS (CUPM).** R. Creighton Buck (*Chairman*), Department of Mathematics, University of Wisconsin, Madison 6, Wisconsin; Robert J. Wisner (*Executive Director*), Committee on the Undergraduate Program in Mathematics, Box 1000, Pontiac, Michigan. (Grantee: Mathematical Association of America.) (1960- )

The Committee on the Undergraduate Program in Mathematics is concerned with the study of the total college mathematics curriculum, spe-

cifically as it relates to each of four areas: the mathematics preparation of teachers for elementary and secondary schools, the training of students interested in the physical sciences and engineering, the preparation of mathematics majors, and the training of students interested in the biological, management, and social sciences.

In the first two areas, the Committee has designed detailed curricula and course syllabi and is encouraging the preparation of preliminary instructional materials at individual institutions. Within the next year, it hopes to have achieved similar progress in the remaining areas.

The Committee is also preparing materials which will assist in the carrying out of its objectives. In particular, a booklet showing how to introduce certain topics in numerical analysis and the theory of computation into courses in the calculus is being prepared.

The concern of CUPM for the college-level curriculum is directed toward its colleagues in mathematics departments across the nation, rather than to the immediate production of texts. It is, however, undertaking the development of course materials for prospective elementary school teachers because of the great need for a variety of materials in this area.

**Sources of further information:**

Copies of the various recommendations and course guides, as well as information about the availability of other reports and summaries may be obtained from the Executive Director.

**NSF EXPERIMENTAL TEACHING PROGRAM IN ALGEBRA.** ROBERT J. WALKER, Department of Mathematics, Cornell University, Ithaca, New York. (1961–1964)

The objective is to develop curricula for a sequence of three one-term courses: *Basic Concepts of Mathematics*, *Linear Algebra*, and *Algebra and Number Theory*. These courses are being designed primarily for future high school teachers, but they also cater to others who do not wish or do not need a more theoretical survey of modern algebra.

The first course treats set theory, axiomatic systems, the real number field and other simple algebraic structures, and cardinal numbers. *Basic Concepts of Mathematics* has a year of calculus for prerequisite (to establish a level of maturity) and carries three hours' credit; this entails three one-hour lectures per week plus an hour of review or supplementary work, depending on the student's ability and interest.

In general, a high degree of abstraction is maintained. There is no plan to compromise with the subject matter. For example, in *Linear Algebra* a linear transformation of one abstract vector space to another is defined first and only then the matrix of a linear transformation relative to chosen bases in the vector spaces. The emphasis is, however, on the application of abstract theorems to concrete situations. Students are not expected to develop facility in proving abstract theorems, but they are expected to have a thorough grasp of the fundamental concepts of modern abstract algebra and its relevance for other fields, especially the "elementary" subjects which are discussed in high schools.

**Sources of further information:**

Since no existing textbooks suitable for the purposes have been found, notes for the courses to serve as text material are being written. These should be in finished form by early 1964. Single copies will be available from the project director.

**NSF EXPERIMENTAL PROGRAM(S) TO PROMOTE UNDERGRADUATE RESEARCH IN MATHEMATICS.** KENNETH O. MAY, Department of Mathematics, Carleton College, Northfield, Minnesota. (1961–1963)

The purpose of the project is to find more effective and economical methods of stimulating gifted undergraduates to do creative work in mathematics and of developing their skill in obtaining and presenting results. During the past six years, this program for gifted students has depended primarily on honors sections in the freshman and sophomore years and on activities centered around a colloquium for advanced students. The hypothesis is now being tested that equally good or better results may be achieved without separate honors sections by organizing colloquia at all levels and making maximum use of a local journal for immediate publication of student work.

**Sources of further information:**

*Undergraduate Research in Mathematics* (report of a conference held under another NSF grant), Carleton Duplicating Service, 1961, is obtainable free from the Department of Mathematics, Carleton College, Northfield, Minnesota. *Delta-Epsilon*, a journal for undergraduate research in mathematics, is published by the department for local circulation but will be sent

free to individuals and libraries upon request. Further information is available from the project director.

**[illegible]**. A. D. Wallace, Department of Mathematics, Tulane University, New Orleans 18, Louisiana. (1961-1962)

The department is experimenting in freshman honors, sections in three areas: (1) improved, quasi-objective criteria for selection; (2) use of laboratory sections; (3) development of new course material. The interest is in a "pure" program for able students involving acceleration but, more basically, laying a foundation for advanced work—"penetration in depth." It is hoped that this will serve as pioneering for the eventual upgrading of all freshman courses at the university. Part-time of the program are: (1) small classes (no more than 25); (2) research mathematicians as teachers; (3) high upward mobility of students and the development of a spirit of inquiry. Work on selection criterion is being done in conjunction with the office of the director of admissions.

**Sources of Further Information**

A report on the project and a limited number of copies of the written materials produced will be available from the project director in the latter half of 1963.

**[illegible] MATHEMATICS COURSES FOR PROSPECTIVE ELEMENTARY SCHOOL TEACHERS.** Joyce R. Mayor and Helen L. Garstens, Department of Mathematics, University of Maryland, College Park, Maryland. (1962-1963)

The purpose of this project is to prepare sample text materials in mathematics for preservice courses for elementary teachers. A course in arithmetic and algebra and a course in geometry are to be prepared. The courses will be tried out and revised upon the basis of the try-out experience. It is intended at this time that each will be a one-semester course, probably of sufficient length to be offered for four semester credit hours. Close attention will be given to the recommendations of the Committee on the Undergraduate Program in Mathematics of the Mathematical Association of America, and of the Teacher Preparation Certification Study of the American Association for the Advancement of Science and the National Association of State Directors of Teacher Education and Certification. The project is a cooperative one under the direction of the University of Maryland Mathematics Project, sponsored by the College of Education and the Department of Mathematics of the University of Maryland. The study is planned for a three-year period.

**Sources of Further Information**

Further information may be obtained from Professor John R. Mayor, University of Maryland Mathematics Project, College of Education, College Park, Maryland.

**[illegible]**. Alexander, College Howard Levi, Department of Mathematics, Columbia University, New York 27, New York. (Present address: Department of Mathematics, Hunter College, 695 Park Avenue, New York 21, New York.) (1962)

A one-semester course in the elementary functions based on the axiomatic use of power series is being developed. The course is suitable for college freshmen and could serve as a terminal course in calculus. Briefly, topics include: (1) Polynomials (including the division algorithm and finite series as formal reciprocals of polynomials); (2) formal power series; (3) power series as functions; (4) functions in general (including continuity, the derivative, maxima and minima); (5) functions as power series (including their characterization by means of functional equations, Taylor's theorem, representability by means of power series).

A rudimentary text with problem material has been prepared. Two classes of high school students have been given a course based on this text. The teachers met regularly with the director to make modifications and additions as circumstances required. The teachers were unusually well qualified, but the students were average college-bound high school seniors. In addition to the project director, other participants in the project are Dr. Harry J. Ruderman, Chairman, Mathematics Department, Hunter College High School, New York 21, New York, and Dr. William Warwick, Chairman, Mathematics Department, Evander Childs High School, New York 67, New York.

**Sources of Further Information**

A revision of the text is in preparation and should be available by December 1962 from the project director.

110. **COORDINATED PROGRAM FOR MATHEMATICS AND PHYSICS MAJORS IN FRESHMAN AND SOPHOMORE YEARS.** REV. CHARLES J. LEWIS, S.J., Department of Mathematics, Fordham University, New York 58, New York. (1962–1964)

The Fordham mathematics and physics departments are collaborating to solve a perennial problem: how properly to organize in sequence the mathematics and physics courses for majors in either of these disciplines. Since these majors are superior students, with four years of mathematics and a year of general physics in their high school training, the new program for them will have the following features:

1. The traditional course in general physics will be dropped from the curriculum.

2. An intensive course in analysis (12 credits), rigorously pursued through most of the usual topics in advanced calculus, will be taken in the freshman year, with six lectures and two drill periods per week. Linear algebra will be developed to the extent (6 weeks) necessary for proper treatment of vector algebra and vector calculus. Applications to topics in physics will be stressed at appropriate stages.

3. In the summer following the freshman year, all students will study selected topics in physics, work assigned problems, and take examinations in the matter assigned upon return in the fall.

4. In the sophomore year instruction in analysis (4 credits) is continued through advanced topics in differential equations and linear analysis.

5. In the sophomore year the students take intensive courses in mechanics (3 credits) and in electricity and magnetism (3 credits), scaled at the level of sophistication and rigor developed in mathematics in freshman year. The mechanics course will include Lagrange's and Hamilton's equations and an introduction to wave mechanics. The electricity and magnetism course will include Maxwell's equations with applications. These courses will be integrated with such topics as potential theory and special relativity theory. Physics majors will take a laboratory course, two hours a week through the year, in experiments related to the courses. In the junior and senior years, other courses will be pitched at a correspondingly higher level.

**Sources of Further Information:**

For the present, further details about the program may be obtained from the director. It is expected that by July 1963 there will be classroom notes available in mechanics, as well as notes in algebra to supplement the analysis course. When the program is completed summary articles will be submitted to the *American Mathematical Monthly* and the *American Journal of Physics*. Neighboring colleges will be invited to attend a conference on curriculum reforms in mathematics and physics, and a report on this project will be presented at the conference.

111. **MATHEMATICS COURSE FOR PROSPECTIVE ELEMENTARY SCHOOL TEACHERS.** RALPH CROUCH, Department of Mathematics, New Mexico State University, University Park, New Mexico. (1962–1963)

This course for prospective elementary school teachers will be a two-semester sequence in the structure of the number system and its sub-systems. The course will follow closely the recommendations of the Committee on the Undergraduate Program in Mathematics of the Mathematical Association of America. It will involve a study of the numbers used in elementary schools —whole numbers, common fractions, decimal fractions, irrational numbers. Emphasis will be on basic concepts and techniques: properties of addition, multiplication, inverses, systems of numerations, and the number line. The techniques for computation with numbers will be derived from the properties and structure of the number system, and some attention will be paid to approximation. Some elementary number theory, including prime number properties, even and odd numbers, and some arithmetic with congruences will be included. The materials will be tested in the academic year 1962-1963 with prospective elementary teachers in several colleges. The materials will also be available for use by teachers in other institutions.

**Sources of Further Information:**

At the end of the project, in the fall of 1963, copies of the final materials will be available to interested persons or institutions. Further information can be obtained from the project director.

112. **FILMS IN MATHEMATICS FOR ELEMENTARY SCHOOL TEACHERS.** E. GLENADINE GIBB, Department of Mathematics, State College of Iowa, Cedar Falls, Iowa. (1962–1963)

The National Science Foundation is providing partial support for development of a series of

lectures and accompanying written materials in connection with a televised in-service program (academic year 1962-63) in mathematics for elementary school teachers in the vicinity of Des Moines, Iowa, supported by the Des Moines Public Schools and the State College of Iowa. Materials developed for the project will be modified, revised, and adapted for use by other school systems interested in a self-service, in-service program in mathematics for the elementary teachers in their schools. The program itself will be based on a series of twelve one-half hour telecasts throughout the year. Elementary teachers will view the telecasts in groups centered at designated schools within Des Moines and its suburban areas. Each viewing group will have a qualified "key" teacher to direct the discussion following the viewing. All "key" teachers will work with Dr. Gibb preceding each television presentation. Study guides and background materials are being developed to be used with and to supplement each telecast. Kinescopes made from the video tapes and materials, revised in light of their use with the Des Moines teachers, will be made available through a cost rental-purchase plan for schools that wish to use them.

**Sources of Further Information:**

Address inquiries for further information to the Director of Field Services, State College of Iowa, Cedar Falls, Iowa.

**112. INTRODUCTORY COURSE ON PROBABILITY, MATRICES, AND CALCULUS FOR STUDENTS IN THE BIOLOGICAL AND SOCIAL SCIENCES.** G. Baley Price, Department of Mathematics, University of Kansas, Lawrence, Kansas. (1962-1964)

The purpose of this project is to develop a mathematics course suitable for freshmen who are interested in the social sciences, the biological sciences, or the management sciences. The traditional mathematics courses for freshmen and sophomores have been especially designed to serve the needs and interests of students of the physical sciences and of engineering. It is hoped that the new mathematics course will be more suitable for the typical student in a college of liberal arts and sciences than those which have been available in the past. The first semester of the new course will treat (1) matrices, (2) sets, relations, and functions, and (3) probability. This material will be taught with an awareness of computing machines. The calculational procedures developed will be those which can be employed readily on a modern digital computing machine. It is likely that two or three weeks will be devoted to a study of simple aspects of programing a digital computer. The second semester of the course will develop differential and integral calculus in a setting of probability theory. The illustrations, applications, and exercises will be drawn from the social, biological, and management sciences. The prerequisite for the new course will be three years of college preparatory mathematics in high school.

**Sources of Further Information:**

Further information is available from the project director.

**114. EXPERIMENTAL CURRICULUM IN ENGINEERING MATHEMATICS.** R. C. Buck and John A. Nohel, Department of Mathematics, University of Wisconsin, Madison 6, Wisconsin. (1962-1964)

The objective of this study is to improve instruction in engineering mathematics. This will be done by developing a number of courses in analysis and algebra along the lines suggested in the detailed recommendations of the Committee on the Undergraduate Program in Mathematics (CUPM). (See **104** above). Specifically, this means a modification of the traditional calculus course to include, within the same time span, much of the basic material in differential equations and certain topics in numerical analysis, related specifically to the role of high speed computers. These topics will not be introduced in isolation but rather as an integral part of the course with full attention to physical motivations where appropriate. In addition, materials will be developed for a one-semester course in linear algebra for engineers, to be taken either in the sophomore or junior year. This course does not now exist in a suitable form.

Materials produced in this project will be available for limited experimentation at other universities and will be available for examination by interested individuals by inquiry to the co-director, John Nohel, after July 1, 1963. These will include discussions of specific physical systems, programs and other materials dealing with numerical analysis, and course notes with exercises for selected topics.

**Sources of Further Information:**

Progress reports will be available periodically from the project directors. Related information

dealing with this and other experimental programs can be obtained from the Committee on the Undergraduate Program in Mathematics, P. O. Box 1000, Pontiac, Michigan.

**115. COURSE IN MATHEMATICS FOR PROSPECTIVE JUNIOR HIGH SCHOOL TEACHERS.** J. MAURICE KINGSTON, Department of Mathematics, University of Washington, Seattle 5, Washington (1962-1963)

This project has as its goal the preparation of materials for use in the training of junior high school mathematics teachers. In recent years the typical mathematics subject matter of grades seven and eight, particularly, has undergone considerable improvement. It has been realized that this is a period during which a strong foundation can be laid for the study of algebra and geometry. Those involved in the project believe that an informal introduction to these subjects can be accomplished which can assist greatly their more detailed study in later grades. Traditionally, the college course in secondary mathematics education has been designed for the senior high school teacher-trainee and little or no attention has been paid to the immediately preceding level where the teacher-trainee will generally not complete a mathematics major. It is intended that the results of this project shall assist in remedying this situation.

The material will include a discussion of the manner in which the concepts of arithmetic are generalized in the study of algebra with emphasis on the basic pattern and structure of the number system of arthmetic and its expansion to the real number system. The fundamental ideas of Euclidean geometry will be established in order to form a satisfactory basis for an informal treatment by the teacher. Some elementary logic will be presented along with an introduction to the language of sets, especially the way in which the latter facilitates the making of accurate and concise statements in algebra and geometry. Considerable attention will be given to numbers in bases other than decimal and to the development of the standard topics of elementary algebra from factoring through the solution of elementary equations. The topics of measurement and approximation will be included along with a brief introduction to elementary statistics.

**Sources of Further Information:**

When completed, the material produced under this project will be available for use by interested persons. The distribution of the material will be handled by the Committee on the Undergraduate Program in Mathematics (CUPM) of the Mathematical Association of America. Requests for information may be made directly to CUPM, P. O. Box 1000, Pontiac, Michigan, or to Dr. Kingston.

# I. Meteorology

**116. COMPUTER APPLICATIONS IN THE ATMOSPHERIC SCIENCES.** *(College, Graduate School)* E. WENDELL HEWSON, Department of Engineering Mechanics (Meteorology), The University of Michigan, Ann Arbor, Michigan. (1962–1964)

Analytical techniques involving electronic computers, both analog and digital, are being employed increasingly in the atmospheric sciences. In some cases, such use of computers has developed into mathematical modeling techniques whereby models formerly too complex for analysis may now be studied in depth. The grant will permit the gathering of a series of typical problems that arise in the atmospheric sciences, together with the techniques for their solution by means of electronic computers, and their organization into a graduate-level course appropriate for the atmospheric science curriculum.

**Sources of Further Information:**

Near the close of the grant period it is proposed to assemble and publish a course manual. This volume will contain sample problems, both with and without solutions, together with textual material relating to the subject matter of the problems, the basic equations involved, and the means of manipulating them into a form suitable for analog or numerical solution. The manual could be used as a textbook for a similar course given elsewhere, and it will be made available for such purposes.

See also:
24. MONOGRAPH SERIES IN METEOROLOGY
35. MOTION PICTURES AND LANTERN SLIDES IN METEOROLOGY

# J. Physics

**117. NEW APPROACH TO THE TEACHING OF QUANTUM MECHANICS.** *(College, Graduate School)* ALFRED LANDÉ, Department of Physics and Astronomy, The Ohio State University, Columbus 10, Ohio. (1958–1960)

Quantum mechanics is usually taught as involving two subjective pictures or as showing that matter has a dual nature. This is also interpreted as a sign of the abstract character of the new theory, consisting of a mathematical schema which "one cannot understand" in a unitary realistic way. In contrast to this view, propagated in particular by Bohr and Heisenberg and represented in the textbooks, the project director pleads for a realistic, objective, and unitary approach to quantum theory as envisaged by Einstein, according to which matter does *not* have a dual nature but consists of particles which have statistical properties sometimes representable by wavelike features as superficial appearances. And whereas duality is usually thought to be ultimate and "fundamental," so that further inquiry into the reason for wave-like appearances is futile, one can actually show that the wave-like quantum laws are consequences of non-wavelike, non-quantal ground assumptions of symmetry, continuity, and invariance, imposed on the general structure of the probability schema. The project director has tried out this new approach in a course on quantum mechanics at Dartmouth College, and he has given about a dozen lectures on the same topic at various symposia in the United States and in Europe.

**Sources of Further Information:**

Alfred Landé, *From Dualism to Unity in Quantum Theory*, Cambridge University Press, London, England, and New York, New York (1960).

**118. LABORATORY TESTS FOR COLLEGE COURSES IN GENERAL PHYSICS.** HAYM KRUGLAK, Department of Physics, Western Michigan University, Kalamazoo, Michigan. (1959–1960)

The primary purpose of the project was the preparation, publication, and distribution of a book on laboratory performance tests in general physics. It was hoped that such a publication would provide college physics teachers with a guide for improving the evaluation of laboratory learning and might also stimulate experimentation leading to improvement in laboratory instruction. The publication, *Laboratory Performance Tests for General Physics* was written by the project director and Dr. C. N. Wall of the University of Minnesota. The booklet contains 165 pages of published and unpublished material on the theoretical and practical aspects of performance test in the general physics laboratory. A number of suggestions are offered on the construction, administration, and scoring of these tests. Over 200 sample items from various branches are reproduced. The booklet also contains a critical review of published research on laboratory instruction in physics and a bibliography, both of which should prove very useful to those doing research in education.

**Sources of Further Information:**

Physics teachers, scientific institutions and libraries may obtain copies of the book from the project director.

**119. COMMISSION ON COLLEGE PHYSICS.** WALTER C. MICHELS *(Chairman)*, Department of Physics, Bryn Mawr College, Bryn Mawr, Pennsylvania; E. D. LAMBE *(Executive Secretary)* (On leave 1962-63 from Department of Physics, State University of New York). (1959– ).

The Commission on College Physics is an independent *ad hoc* group of seventeen physicists, established by the American Association of Physics Teachers. It is dedicated to the improvement of undergraduate instruction in physics at all levels from the introductory course through the senior year of physics majors. Recognizing that this improvement can be made only by the departments and individuals responsible for physics teaching, the Commission considers that the major *action* toward its objectives should be taken by universities, colleges, and professional physics organizations. It considers its own function to be one of acting as a "nerve center" for curriculum development. In this capacity it collects information about physics teaching and experiments for its improvement, distributes this information to those whose activities may be affected by it, encourages new developments in course content, laboratory practice, laboratory apparatus, teaching aids, etc., and assists institutions in the organization of institutes and conferences for college physics teachers.

Among the recent and current activities of the

Commission are:

1. Preparation and publication of a series of paperback books ("Momentum Books" published by D. Van Nostrand Company, Inc.) suitable for supplementary reading by college physics students. The first books of the series are expected to be available in 1963.

2. Preparation and circulation of a series of *Resource Letters* designed to assist instructors in finding literature references, apparatus, and teaching aids in particular areas of physics. This activity is now being taken over by the American Association of Physics Teachers.

3. Organization of a series of conferences (see **126** below) designed to study the best ways of preparing physics majors for professional and graduate work.

4. Studies of new apparatus, films, etc. These are accomplished by arranging for loans to physics departments and by asking for critical evaluations.

5. The conduct of small conferences to develop sound approaches to the teaching of special branches of physics, particularly those that are currently being introduced into the undergraduate curriculum. Whenever practicable, these conferences are to be followed by summer conferences at which college teachers will be introduced to the new approaches.

6. Cooperation with institutions trying experiments in physics teaching, especially at the freshman-sophomore level.

7. Cooperation with institutions that are producing instructional films for college use.

**Sources of Further Information:**

Walter C. Michels, "Commission on College Physics," *American Journal of Physics* 28, 611 (1960).

"The Report of the Denver Conference on Curricula for Undergraduate Majors in Physics," *American Journal of Physics* **30**, 153 (1962).

"Progress Report, June 1960–May 1962." *American Journal of Physics* (in press).

Requests to be placed on the mailing list for the Comission newsletter should be addressed to the Commission at Bryn Mawr College.

**120. SUMMER WORKSHOP IN INTRODUCTORY COLLEGE PHYSICS.** ROBERT RESNICK and HARRY F. MEINERS, Department of Physics, Rensselaer Polytechnic Institute, Troy, New York. (1960–1961)

Five physicists were selected from applicants at other institutions to participate with the Rensselaer staff and supporting personnel in an eight-week summer program to develop demonstration and laboratory apparatus for the introductory college physics course. Forty-eight projects were started in the workshop and later completed at Rensselaer. A report containing a description of each of the forty-eight completed projects was prepared and distributed to 600 interested individuals and institutions. This report contains a detailed drawing and a materials list for each piece of equipment developed, as well as directions for use and other pertinent comments. Projects include Ion Motor, Driven Linear Oscillator, Stroboscopic Techniques, Fluorescent Optical Models, Hysteresis Demonstrator, Discharge Tube, Photoelectric Trigger, Measurement of Hall Coefficient, Harmonic Analyzer, Plastic Dry Ice Pucks, Bragg Reflection with Ripples, Two-Dimensional Kinetic Theory Model, X-Y Plotter, and Orbital Motion.

**Sources of Further Information:**

American Institute of Physics *Newsletter* (March 1961).

Proceedings of the American Association of Physics Teachers, *American Journal of Physics*, **29**, xii (1961).

The 185-page volume, *Demonstration and Laboratory Apparatus Report of the 1960 Summer Visiting Professor Workshop*, can be obtained for $3.85 from the Rensselaer Union Book Store, Rensselaer Polytechnic Institute, Troy, New York.

**121. LECTURE DEMONSTRATIONS AND LABORATORY EXERCISES FOR INTRODUCTORY COLLEGE PHYSICS.** JOHN FOWLER, Department of Physics, Washington University, St. Louis 3, Missouri, and E. D. LAMBE, Department of Physics, State University of New York, Stony Brook, Long Island, New York. (Address 1962–63: Commission on College Physics, Bryn Mawr College, Bryn Mawr, Pennsylvania.) (1960– )

The project directors have been developing an introductory physics course offered to all students: science majors, engineers, premedical majors, etc. This course has among its goals an emphasis on the elementary concepts and laws of physics rather than their application and seeks to provide some quantitative insight into relativity and quantum theory. The implementation

of these goals requires much development of laboratory equipment and lecture demonstrations. The laboratory is used to provide the phenomenological background which complements the more abstract orientation of the lecture, to teach certain subjects (e.g., geometrical optics) independently of the lectures, and to emphasize points introduced in lectures. Several experiments have been designed, e.g., one in simple astronomy and one demonstrating the photoelectric effect. The lecture demonstrations have been developed with an eye to simplicity of operation and description and multiplicity of use. The attempt has been to produce demonstration equipment which can be used over a period of several lectures to follow ideas of increasing complexity. Major emphasis has been in the general areas of particle mechanics, wave motion, and wave particle physics. Examples of specific areas in which materials have been developed include frames of reference, collisions, wave propagation in a one-dimensional medium, and electron diffraction.

**Sources of Further Information:**

Articles describing a simple electron diffraction demonstration using a TV tube and a one-dimensional wave medium were submitted early in 1962 to the *American Journal of Physics* and in a book, *A Reference Source for Demonstration Experiments in Physics*, to be published by the American Association of Physics Teachers. Further information is available from Dr. Fowler.

**122. SCIENCE TEACHING CENTER: COLLEGE PHYSICS.** JERROLD R. ZACHARIAS, Department of Physics, Massachusetts Institute of Technology, Cambridge 39, Massachusetts. (1961– )

The Science Teaching Center is concerned with the beginning college physics course and the need to indicate in such a course the scope of present knowledge, the aims and historical development of science, and the role of science in our culture. Proposed revision of the elementary physics course is proceeding along several different lines: (1) Selecting topics, preparing a course outline, and preparing written materials to help students gain some understanding of modern physics—relativity, quantum physics, the solid state; (2) developing student laboratory experiments to support the new content; (3) producing kits of experimental apparatus to be used by students largely on their own; (4) producing films as brief demonstrations or at greater length as extensions of student laboratory where the apparatus is too expensive or inconvenient.

**Sources of Further Information:**

Laboratory kits are available from Macalaster Scientific Corporation, 253 Norfolk Street, Cambridge 39, Massachusetts. Persons interested in trying out the materials should write to the Commission on College Physics, Bryn Mawr College, Bryn Mawr, Pennsylvania. Specific information about the project may be obtained from Mr. Malcolm K. Smith, Science Teaching Center, Room 6-208, Massachusetts Institute of Technology, Cambridge 39, Massachusetts.

**123. FILMS FOR COLLEGES AND UNIVERSITY PHYSICS COURSES.** JERROLD R. ZACHARIAS and JAMES S. STRICKLAND, Educational Services Incorporated (for the Commission on College Physics), 164 Main Street, Watertown 72, Massachusetts. (1961– )

In order to provide college and university physics courses with film material of the quality of the Physical Science Study Committee films, Educational Services Incorporated is now producing six to eight 10 to 40-minute college level physics films with associated materials such as film notes, journal articles, graphs, photographs, filmstrips, and slides when and as desirable. Four films are already being distributed: *Ripple Tank Wave Phenomena*, Parts I and III; *The Ultimate Speed;* and *The Size of Atoms from an Atomic Beam Experiment*. Three others are in production: *Ripple Tank Wave Phenomena*, Part II; *Momentum of Electrons;* and *Time Dilation*. Other films now being planned are: *Radiation from Radioactive Nuclei, Radiation Pressure, Rutherford Scattering, Elementary Particles*, and *Superconductivity and Other Phenomena at Liquid Helium Temperatures*. The purpose of the films is to bring to college physics courses experiments, effects, and visual material that would be difficult for the student to obtain or perform on his own. The films as they are produced will be distributed temporarily by Educational Services Incorporated.

**Sources of Further Information:**

Further information may be obtained from Dr. Strickland at Educational Services Incorporated.

**124. SOURCEBOOK FOR DEMONSTRATION EXPERIMENTS IN PHYSICS.** HARRY F. MEINERS and ROBERT RESNICK, Department of Physics, Rensselaer Polytechnic Institute, Troy, New York. (Grantee: American Association of Physics Teachers.) (1961–1963)

The aim of this project is to prepare a new reference text which will bring together under one cover the best demonstration equipment and techniques in physics now available. Renesselaer Polytechnic Institute has agreed to serve as the coordinating center for this program of the American Association of Physics Teachers. The new text, to be entitled *A Reference Source for Demonstration Experiments in Physics*, will consist of descriptions of demonstration equipment and their use in lectures, photographs, lists and sources of materials and, where appropriate, working schematics to make construction by individuals possible. Emphasis in the selection of material will be placed on demonstrations related to the concepts of modern microscopic physics. In addition, there will be commissioned articles on selected subjects such as the role and purpose of lecture demonstrations, the art of demonstrating and the use of audio-visual techniques including the overhead projector, closed-circuit television, films, shadow projection, and stroboscopic effects. The new volume follows an earlier book, *Demonstration Experiments in Physics*, also prepared under the sponsorship of the AAPT and published in 1938. Contributions are being solicited from as broad a group as possible. They are then submitted to members of an advisory committee for evaluation and screening. After review and acceptance by the advisory committee, contributions are prepared for publication by the directors and their staff.

**Sources of Further Information:**

A brochure explaining all aspects of the program, including directions for preparation of material to be submitted for inclusion in the book, is available on request from Harry F. Meiners, Demonstration Book Project, Science Center, Rensselaer Polytechnic Institute, Troy, New York.

**125. SOURCE MATERIALS FOR THE HISTORY OF RECENT PHYSICS IN THE UNITED STATES.** *(College, Graduate School)* W. JAMES KING, American Institute of Physics, 335 East 45th Street, New York 17, New York. (1961–1963)

The major objectives of this project are:

1. To locate documents of potential significance for studying the development of physics, both as a research discipline and a profession and to locate the apparatus used in significant research. The period investigated begins when physics in America became comparable in breadth, if not in depth, to research in Europe, a period beginning about the last decade or so of the last century and continuing to the present.

2. To take steps toward the preservation of documentary materials. The project staff will recommend to the institution where the research was originally carried out that primary source material, either manuscripts or apparatus, be preserved and catalogued. If that institution should not be interested in taking active steps toward its preservation, recommendations will be made to appropriate libraries or museums. An archival collection of documentary materials will be established in the Bohr Library of the American Institute of Physics.

3. To make and record interviews with physicists associated with some of the more fundamental discoveries made in the United States and to obtain photographic or other records of apparatus used in important researches. The photographic record is particularly important where the equipment would not otherwise be preserved.

4. To organize a biographical-bibliographical collection of data on American physicists and to organize a locator file of historical materials on physics in the United States.

5. To assist physics instructors, historians of science, science museums and others interested in studying or presenting the history of physics by making available to them the information preserved in the archives of the American Institute of Physics or by referring them to collections of important materials elsewhere.

6. To encourage and initiate the use by scholars of archival material at the American Institute of Physics. For example, plans are under development to prepare some guides, and possibly a *catalogue raisonné* based upon the material, dealing systematically with the development of recent physics in America within the framework of the historical development of physics throughout the world.

**Sources of Further Information:**

*Physics Today* 15, 44 (1962).

Further information may be obtained from the project director.

**126. REVIEW CONFERENCE ON COMMISSION ON COLLEGE PHYSICS.** FRANK VERBRUGGE (President, American Association of Physics Teachers), Institute of Technology, University of Minnesota, Minneapolis 14, Minnesota. (Grantee: American Association of Physics Teachers.) (1961–1962)

A conference of 75 participants met at St. Olaf College, Northfield, Minnesota, June 28-30, 1962, for the following purposes: (1) to review the work to date of the Commission on College Physics (see **119** above); (2) to advise the Commission on its further program; (3) to elect seven new commissioners to replace those whose terms had expired; and (4) to establish procedures for future review of Commission activities and procedures for future election of commissioners. In addition, there were group discussions of testing and evaluation, visual aids and other educational media, apparatus development, and programs for superior students. The commissioners themselves were numbered among the 75 participants. The remaining participants were selected by a Review Conference Selection Committee which based its choices on nominations provided by a poll of all academic physics departments as listed in the 1960–61 AAPT-AIP Directory of Academic Physics Departments.

**Sources of Further Information:**

Further information may be obtained from the project director.

**127. SHORT FILMS IN PHYSICS.** *(College, Secondary)* FRANKLIN MILLER, JR., Department of Physics, Kenyon College, Gambier, Ohio. (1961–1962)

Approximately 20 short live-action film clips are being produced, each about 3 minutes in length, designed to help physics instructors present concepts and demonstrations which are difficult or impossible to present otherwise in classroom or lecture hall. Using the self-loading or cartridge-type film projectors which are now commerically available, a teacher will be able to present brief, essential, difficult-to-demonstrate concepts in a classroom situation of his own devising without breaking the thread of his presentation. The film clips are 16-mm, in color, with provision for reduction to 8-mm for use in 50-foot cartridges. Since only the essential action is shown, many teachers will prefer to use the clips silently, although a voice-over sound track is being provided for the 16-mm version. While primarily designed for college courses, most of the clips will also be useful in secondary school courses. A user's manual is planned. Distribution of film clips will be through a channel still to be selected.

The film clip series includes the following subjects:

1. *Coupled Oscillators—Equal Masses*
2. *Coupled Oscillators—Unequal Masses*
3. *Measurement of "G"—The Cavendish Experiment*
4. *Inertial Forces—Translational Acceleration*
5. *Inertial Forces—Centripetal Acceleration*
6. *The Wilberforce Pendulum*
7. *Radioactive Decay*
8. *Scintillation Spectrometry*
9. *Zeeman Effect*
10. *Absorption Spectra*
11. *Single Slit*
12. *Double Slit*
13. *Resolving Power*
14. *Michelson Interferometer*
15. *Temperature Waves*
16. *Nonrecurrent Wavefronts*
17. *Tacoma Narrows Bridge Collapse*
18. *Ferromagnetic Domains*
19. *Paramagnetism of Liquid Oxygen*
20. *Critical Temperature*

**Sources of Further Information:**

Further information is available from the project director.

**128. TWO CONFERENCES ON CURRICULA FOR UNDERGRADUATE MAJORS IN PHYSICS.** H. R. CRANE, Department of Physics, University of Michigan, Ann Arbor, Michigan. (1962–1963)

The purpose of this project is to develop suggestions and recomendations on curricula for undergraduate students in physics. In the summer of 1961, the University of Denver sponsored three conferences, each attended by 60 physicists, which considered curricula in physics in small colleges. One of the two conferences in the present project was held at the University of Michigan in June 1962 and brought representatives of universities granting the Ph.D. in physics to consider undergraduate training appropriate for students who will continue into graduate school. The second conference will include physicists who attended the Denver meetings and physicists who participated in the first Michigan session; its

assignment will be to draw all viewpoints together in preparing recommendations on optimal undergraduate programs. Consideration will also be given to means for improving interaction between graduate and undergraduate schools. The Denver and Michigan conferences are outgrowths of the work of the Commission on College Physics.

**Sources of Further Information:**

Conference Report Committee, "Report of the Denver Conference on Curricula for Undergraduate Majors in Physics," *American Journal of Physics* 30, 153 (1962).

Information and reports on the Michigan conferences will be available from the project director.

**129. FILM ON LOW TEMPERATURE PHENOMENA.** ALFRED LEITNER, Department of Physics, Michigan State University, East Lansing, Michigan. (1962–1963)

A 16-mm black-and-white sound film (estimated length: 30 minutes) will be produced demonstrating properties of liquid helium in the superfluid state. Subjects treated will include:

1. Production of liquid helium, its storage and transfer.

2. Cooling by evaporation. Lambda point transition. The finite bulk viscosity below the lambda point *vs.* the zero viscosity flow due to fountain pressure. The zero thermal energy in the fluid participating in this flow.

3. The two-fluid model.

4. The Rollin (creeping) film.

5. Refinements over the two-fluid model. Second sound.

**Sources of Further Information:**

It is estimated that the film will be available by February 1963 for rent or purchase from commercial distributors not yet chosen. Interested persons should write the project director asking to be informed when the film is available.

**130. AN ELEMENTARY COLLEGE PHYSICS COURSE.** CHARLES KITTEL, Department of Physics, University of California, Berkeley 4, California. (Grantee: Educational Services Incorporated, 164 Main Street, Watertown 72, Massachusetts.) (1962–1964)

It is intended to develop a new college physics course which will reflect from the outset the series of profound changes that physics has undergone since the last decade of the nineteenth century. The new course will be qualitatively different from the traditional course in physics for scientists and engineers, just as the physics of this decade is qualitatively different from the physics of 1890. Relativity, statistical mechanics, and quantum mechanics will join Newtonian mechanics and Maxwell's equations as fundamental foundations of physics. The course will build on the Physical Science Study Committee material or an equivalent secondary school physics background, will be designed for students who will become scientists or engineers, and will be developed by physicists from several institutions, working in the mainstream of modern physics.

The course will emphasize:

1. The foundations of physics from the standpoint of invariance arguments and other arguments with elegance, simplicity, and wide applicability.

2. Critical accounts of the crucial experiments in modern physics. Original data will be presented where possible, and experimental facts will be stressed.

3. Application of physical principles to new situations, stressing the use of dimensional arguments. Considerable reliance will be placed on the exercises for the standard material in classical mechanics.

4. Calculus will be required to be taken concurrently. Other mathematical tools will be developed as required to include probably vector and scalar products, 2 x 2 matrices, eigenvalues, and eigenfunctions of matrices and simple differential equations.

**Sources of Further Information:**

An announcement of this project giving somewhat more information than the above will be submitted to the *American Journal of Physics*. Requests for further information should be addressed to Prof. W. B. Fretter, Department of Physics, University of California, Berkeley 4, California.

**See also:**
37. PHYSICAL SCIENCE STUDY COMMITTEE—ADVANCED TOPICS
50. LABORATORY COURSE IN INSTRUMENTATION
110. COORDINATED PROGRAM FOR MATHEMATICS AND PHYSICS MAJORS IN FRESHMAN AND SOPHOMORE YEARS

# K. Psychology

**131. STUDY OF THE UNDERGRADUATE CURRICULUM IN PSYCHOLOGY.** W. J. McKEACHIE and J. E. MILHOLLAND, Department of Psychology, The University of Michigan, Ann Arbor, Michigan. (1959–1961)

The first phase of this study was a questionnaire survey of all the degree-granting departments of psychology in the country, carried out during the academic year 1959–60. This survey attempted to ascertain the extent to which the curriculum proposed in *Improving Undergraduate Instruction in Psychology* (D. Wolfle, et al., Macmillan, 1952) has been put into practice and to solicit opinions of its value.

The second phase was an eight-week conference at Ann Arbor during the summer of 1960. Full-time participants, in addition to the directors of the project, were Lawrence E. Cole, Oberlin College; William Hunt, Northwestern University; Robert Leeper, The University of Oregon; and Wilbert Ray, Bethany College. There were three half-time participants from The University of Michigan: Robert L. Isaacson, James V. McConnell, and Edward L. Walker.

The chapters in the published report of the Conference are as follows:

1. Introduction
2. Experiences with the Wolfle Curriculum
3. Pressures on the Curriculum
4. Preprofessional and Vocational Training
5. The Beginning Course
6. The Experimental-Statistical Area
7. Three Model Curricula for the Major
8. Suggestions for Research
9. Annotated Bibliography

**Sources of Further Information:**

The following book is the report of the conference: W. J. McKeachie and J. E. Milholland, editors, *Undergraduate Curricula in Psychology: Report of the Michigan Conference*, Scott, Foresman and Company, Chicago, Illinois (1961).

**132. FILM SERIES ON SCIENTIFIC DEVELOPMENTS IN PSYCHOLOGY.** *(Secondary, College)* JOHN G. DARLEY, American Psychological Association, 1333 Sixteenth Street, N.W., Washington 6, D.C., and ROBERT B. HUDSON, National Educational Television and Radio Center, 10 Columbus Circle, New York 19, New York. (Grantee: American Psychological Association.) (1961–1963)

The following ten 30-minute filmed programs in psychology are currently in production and scheduled for completion by 1963. The films are in black-and-white, with sound.

1. *The Brain and the Nervous System.* Present research on the brain and the nervous system, with a discussion of brain functions by area.

2. *Sensory Processes and Perception.* The "interpretation" or "processing" of information received by the organism from the environment.

3. *Growth and Development.* Growth in children, illustrating the development of motor abilities and more complex activities.

4. *Motivation and Personality.* Factors involved in the motivation and personality of living organisms interacting with the environment.

5. *Learning and Thinking.* Some of the new facts and theories of learning and possibly some of the new educational devices for teaching.

6. *Computers and Human Mental Processes.* Use of computers in psychology for greater refinement of measurement and analysis of data.

7. *Individual Differences and Psychological Tests.* Developments in measurement and analysis of human capacities and individual differences of living organisms.

8. *Social Psychology and Group Process.* Man's behavior in relationship to other men and the society in which he lives.

9. *Human Engineering and Biomechanics.* Applications of psychological principles to the understanding of an efficient use of men and machinery; instrumentation, special studies of safety factors, and training devices.

10. *Psychopharmacology.* A report on one of the newest areas of psychological investigation, highlighted by showing the effects of drugs on behavior, particularly as a means of elucidating the functions of the organism.

**Sources of Further Information:**

The series of films will be made available to the 50 or more educational television stations in the United States for distribution in classroom and audio-visual use, for closed-circuit television, for appropriate adult education activities, and for educational use abroad. Inquiries should be addressed to the National Educational Television and Radio Center, 10 Columbus Circle, New York 19, New York.

Diagrams of $BeH_2$ (linear), $BF_3$ (planar-trigonal) and $CH_4$ (tetrahedral); only one p orbital of each fluorine atom is shown (*Courtesy Chemical Bond Approach Project*—Project **20**).

Problem from *Sets and Numbers*, a book for kindergarten students (*Courtesy Patrick Suppes, Elementary School Mathematics Project, Stanford University* — Project **1**).

Streamlined airfoil at excessive angle of attack, resulting in separation of the boundary layer and airfoil stall (*Courtesy Professor F. M. N. Brown, University of Notre Dame*. Equipment for producing such flow visualizations is described in the companion book of Science Teaching Development Projects).

The Watson-Crick model of the desoxyribonucleic acid molecule (*Courtesy Biological Sciences Curriculum Study*—Project **16**).

Interference pattern of waves in a ripple tank (*Courtesy Physical Science Study Committee*—Project **36**).

Potential energy diagram for the uncatalyzed decomposition of formic acid (*Courtesy Chemical Education Material Study* — Project **21**).

Representation of a composite function as a machine from *Elementary Functions*, a twelfth grade text (Courtesy School Mathematics Study Group — Project **30**).

Eratosthenes' method for indirect measurement of the size of the earth (*University of Illinois, Elementary School Science Project*—Project **10**).

At left, model of poliomyelitis virus particle, the surface of which consists of 60 roughly spherical protein units arranged in 12 pentagons and a large number of equilateral triangles. At right, model of a portion of a tobacco mosaic virus particle showing spiral arrangement of protein units (*Courtesy University of California Virus Laboratory, and Virology Film Project*—Project **17**).